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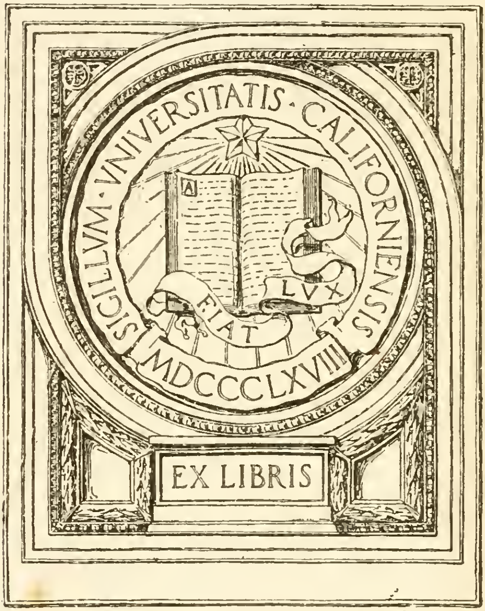
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THE PHILIPPINE ISLANDS

THEIR INDUSTRIAL AND COMMERCIAL POSSIBILITIES

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

The Country and the People

HC455
P5

PHILIPPINE INDUSTRIAL PRODUCTS

A large proportion of the Philippine goods for sale consists of articles de by the children in the public schools of the Philippine Islands. The sales gs on school made articles contain interesting information on their making. e industrial program of the Philippine schools is concerned largely in teaching e pupils useful household industries in a commercial way, and in controlling d directing along proper lines the industries thus being built up.

MBROIDERIES—The finest hand made embroideries on genuine linen, doilies, handkerchiefs, baby dresses, ladies' dresses, blouses, flounces and nightgowns. Beautiful embroideries on the delicate piña, a native cloth made from pineapple fiber.

ACES—A large assortment of hand made laces, of genuine imported Irish and Belgian threads.

ASKETS—A splendid assortment of hand made baskets in standard and special forms and weaves; Malaysian designs; ceremonial baskets; made of Philippine fibers, in beautiful natural color combinations. In design and workmanship, these Philippine baskets set a new standard for the world in basketry.

ATS—Fine woven bamboo, buntal and calasiao hats; single and double hats in standard and special weaves; styles for men and women. Some of these hats set new standards in Panamas. American manufacturers use the buntal for their latest modes. Bamboo hats are made of fine bamboo splints; the fiber of the buntal hats is extracted from the buri palm petiole; the material of the calasiao hats is prepared from the mid-rib of the buri palm leaf.

ATS—Porch and chair mats of grasses and sages in attractive colors and designs. Mattings in materials new to the trade. Calabugan mats and hangings from the wilds of Mindanao.

PINA—This gauzy native Philippine cloth is woven on home looms in th Islands from the delicate fiber of the pineapple plant.

JUSI—A beautiful gauzy dress material of raw silk, woven on Philippine hom looms, in striped silk patterns.

SINAMAY—The dress material of the Philippine Islands, a cloth in severa grades woven from abaca (Manila hemp) fiber; in colors; has many othe uses.

MORO BRASSES—Decorative, ornamental, and decorative articles of han pounded brass, made by the Mohammedan Moros of the southern islands Bowls, vases, trays, boxes, etc., pieces small and large, in rich Moro designs; brasses inlaid with silver and other metals.

CARVED BOXES—Boxes large and small, jewel boxes, clothes chests, an intermediate sizes for many uses. Made of finest Philippine woods, han carved in elaborate designs.

PORCH FURNITURE—Tables, chairs, screens, hangings, and other furniture for porch and bungalow, made of rattan with woven covering. Attractive, comfortable and convenient; peacock chairs and other pieces i intricate and pleasing design.

HARDWOOD FURNITURE—Office and home furniture in single piece and in sets, in such beautiful Philippine hardwoods as narra, tindalo, ipi acle, camagon, tanguile, etc.; heavy and serviceable, of correct desigr highly polished.

VARIOUS CLOTHS—Moro cloths and cloths from the Mountain countr in cotton and other materials; scarfs, table and sideboard runners.

SOUVENIRS—Spears, bolos, beads and bead work, pearl shell product silver articles, small articles of hardwood, shell lamp shades, toys, misce laneous.

THE PHILIPPINE ISLANDS

—SOME FACTS AND FIGURES—

The Islands were discovered by Magellan in 1521. The first Spanish overnor was Legaspi, 1571. They have enjoyed a European civilization after panish ideals for more than 300 years. The American civil government was stablished under Wm. H. Taft, 1901.

The Archipelago embraces approximately 3000 islands. The distance rom north to south is 1,152 miles, and from east to west 682 miles. The area 127,853 square miles, about five-sixths as large as the State of California.

The people belong to the Malay race. About one-tenth of the popula- on is found among the mountain peoples of Luzon and Mindanao and the ohammedans of the southern islands. The present population is about ,000,000, including 40,000 Chinese, 4,000 Spaniards, 8,000 Americans (ex- lusive of American soldiers), and 3,000 other foreigners.

The principal exports are hemp, cocoanut products, sugar, tobacco and orest products.

The entire cost of the Philippine Government is paid by the people of the hilippine Islands themselves under a well-ordered system of taxation. The tal annual per capita tax for all government purposes is, in round numbers, wo Dollars.

English has been the language of instruction in the public schools since 899, and is the official language today. The Filipinos speak as their mother ngue dialects of the Malay language.

The Filipinos are Christians, the only Christian people in the Far East.

The University of Santo Tomas was founded in 1610, and is the oldest niversity under the American flag. The first steps towards popular education ere taken in 1634.

The American public school system established throughout the Islands nbraces the following features: graded courses—primary, intermediate, sec- dary, university; balanced curriculum—academic, vocational, physical. Voca- onal specialization in the grammar grades. Differentiation of work for boys d girls.

The total number of schools is 4,200. The annual enrollment is 600,000, d the average daily attendance is 460,000. There are 530 American achers and 9,400 Filipino teachers.

The Philippine Islands are represented at the Panama-Pacific International xposition with extensive exhibits in the Philippine Pavilion, the Departments Education and Social Economy, the Palace of Agriculture and the Palace of ine Arts. The general purposes of the exhibit are to spread information on the ltural and other conditions of the Filipinos, the progress they have made in the st decade and a half, and the immense industrial and commercial opportuni- s which they offer.

THE PHILIPPINE ISLANDS

GIFT
OCT 8 1915

CLIMATE

in the

PANAMA PACIFIC
INTERNATIONAL EXPOSITION
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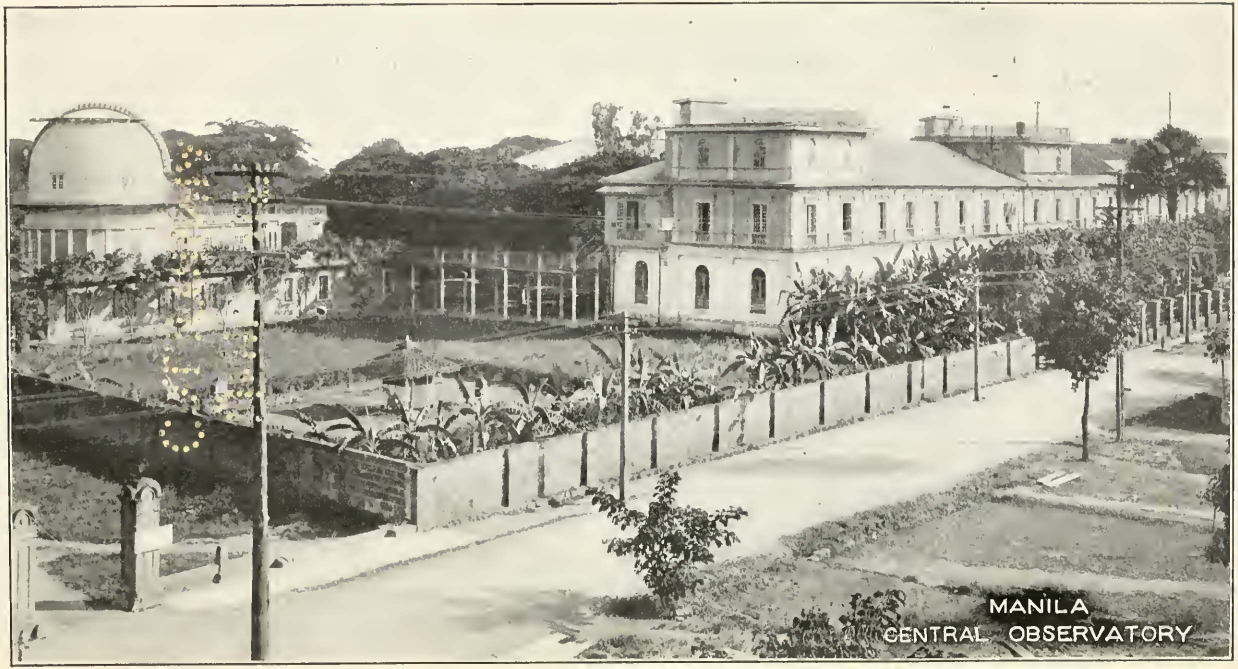

MANILA
CENTRAL OBSERVATORY

CLIMATE OF THE PHILIPPINES

By Rev. P. José Algué, *Director, Weather Bureau*

THE extension of the Philippine Archipelago from north to south of over 13 degrees in the Tropics, its division into nearly 3,000 islands, the varying form and area of these islands, some, as Luzon and Mindanao, covering an extent of over 30,000 square miles, 9 having a surface of between 1,000 and 6,000 square miles, 20 between 100 and 1,000, 73 between 1 and 10 square miles, with about 2,375 islets of less than 1 square mile each, and the relief of some of the largest islands, constituting various plateaus in the mountainous regions, give rise to a decided variety of climatic conditions which cannot be comprehended in a single or uniform type of climate. Therefore, in dealings with the climate of these Islands, I shall endeavor to classify it into different types which may represent approximately the different varieties of weather experienced in the various regions of the Archipelago. This attempt is to be necessarily empyrical or based on observation and experience. The basis for this classification is the local air currents as due to the relative position and size of the islands. The local air currents are caused by the various thermal conditions of the continents and oceans, or, in our case, of the islands and adjacent seas, and they are more or less independent from small differences of latitude; while the general air currents or trade winds are caused by the thermal differences between polar and equatorial regions, or they owe their existence to the normal differences of temperature corresponding to latitude.[1] How slight is the influence of the general currents or latitude alone on some of the climatic elements, for instance temperature, in the different regions of the Philippines, may be illustrated by the fact that the highest recorded temperature for seven years in Jolo, latitude, 6° 3′ N., is 36.5° C., and for eight years in Aparri, latitude 18° 22′ N., 37.8° C. Besides, the yearly mean maximum temperature for the same period is 30.6° C. in Jolo and 30.2° C. in Aparri, and the average mean temperature of the hottest months is 26.8° C. in Jolo and 28° C. in Aparri, and finally the yearly mean minimum temperature is 22.6° C. for Aparri, and 22.8° C. for Jolo. The difference therefore, of climatic

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[1] See "The cyclones of the Far East," p. 123.

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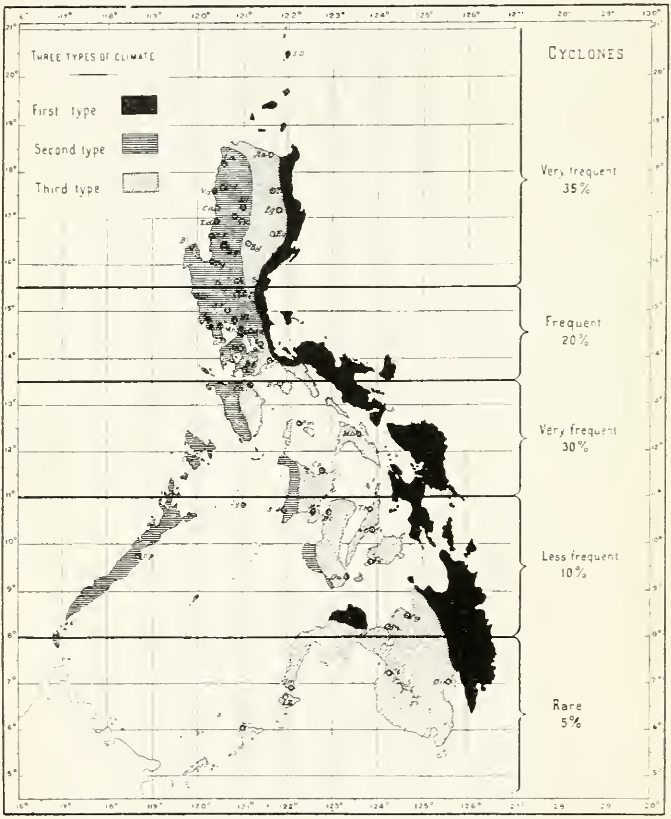
conditions in the different parts of the Archipelago depends mostly on the local currents as a combined resultant of the general winds, position of the islands, and storm centers. Generally speaking, we may assume that the resultant direction of these currents in the Philippines is from north

CLIMATE OF THE PHILIPPINE ISLANDS

Plate A



to east during the period October to January, from east to southeast from February to April, and for the rest of the year southerly directions ranging from southeast to southwest predominate, due chiefly to storm centers. We may add that such currents are the principal cause of the distribution of rain, which constitutes a very important factor of climate. We may further add that as the result of long experience it may be stated that, in the Philippines, currents from northwest to west and southwest are generally either cyclonic or of cyclonic origin.[2] Hence, for the purpose of classification we shall divide the whole group of islands into regions directly influenced by northeasterly and easterly currents and regions not directly influenced by such currents. The climatic conditions observed in the first regions will constitute the first type of climate in the Philippines. The climatic conditions in the other regions will make the second type of climate in the Philippines. Besides, there are regions in the Philippines which are only in part affected by northeasterly and easterly currents and the climatic conditions of such regions may form another type of climate which we shall call intermediate climate.

There are, consequently, in the Philippines three types of climatic conditions which we may formulate as follows:

1. Climatic conditions over the small islands or portions of large islands at or near the sea level, below 80 meters of altitude, freely exposed to air currents from north to east or southeast and not distant from the Pacific Ocean.

2. Climatic conditions over the small islands or portions of large islands at or near the sea level not freely exposed to currents from north to east or southeast and distant from the Pacific Ocean.

3. Climatic conditions over the small islands or over portions of large islands only partly exposed to northeasterly and easterly currents, or, if exposed to such currents, distant from the Pacific Ocean.

Mountain climates may form another type of climate, but they can be reduced to some of the above types as far as some meteorological or climatological elements are concerned, except temperature which decreases with the altitude, and rain which increases with height, generally. Thus the climate of Baguio, Benguet, may be classified as of the second type, with lower temperature; the climate of Bontoc belongs also to the second type; the climate of the high plateaus in the Tayabas Province belong either to the first or to the intermediate type, with milder temperature; and, finally, the high plateaus in Mindanao, in the Misamis and Moro Provinces belong to the third or intermediate type, with lower temperature.

I will try to deduce the most characteristic features of each type from two instances of each and then give a list of places or regions under the same climatic conditions.

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[2] See "The cyclones of the Far East," p. 124 et seq.

FIRST TYPE—LEGASPI AND SURIGAO

LEGASPI

Climate of Legaspi.—We shall consider only the most important elements of climate viz, rainfall and its distribution throughout the year, cloudiness, humidity, and temperature; occasionally we will point out the effect of other elements, as wind and air pressure, to make each type better known.

The amount of rainfall will be given in millimeters, the temperature in degrees centigrade, the humidity in hundredths, and the amount of clouds according to the scale (0–10) as usual, 0 meaning entirely clear and 10 completely overcast.

Rain.—Distribution of rainfall (mean of seventeen years) per month is as follows: January, 377.6 mm.; February, 299.9 mm.; March, 172.6 mm.; April, 171 mm.; May, 132.8 mm.; June, 174.3 mm.; July, 261.1 mm.; August, 176.7 mm.; September, 250.4 mm.; October, 344 mm.; November, 348.7 mm.; December, 483.6 mm.; total, 3,192.7 mm.

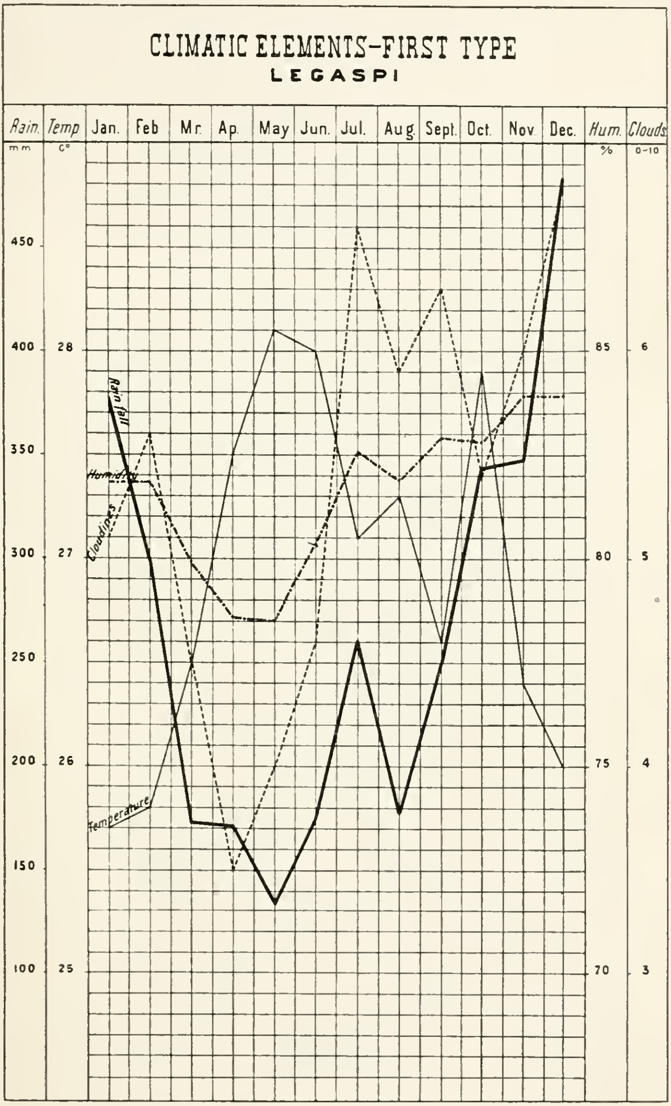
There is no dry season in Legaspi and the maximum amount of rain falls in December and the minimum in May. Rains of April and May are generally caused by thunderstorms and occasionally by cyclones. Rains from June to September are caused by electric and cyclonic storms. Rains from September to March are due to air currents from the Pacific.

Cloudiness.—Cloudiness follows closely the distribution of rain as per the following average monthly record: January, 5.1; February, 5.6; March, 4.5; April, 3.5; May, 4.0; June, 4.6; July, 6.6; August, 5.9; September, 6.3; October, 5.4; November, 6.0; and December, 6.8. Maximum cloudiness in December, minimum in April. Larger percentage of clouds from September to March due to prevalence of northeasterly and easterly currents. Clearest sky in April.

Humidity.—The average variation of the relative humidity per month is taken from hourly observations during the years 1908–1913: January, 81.8; February, 81.8; March, 79.9; April, 78.6; May, 78.5; June, 80.3; July, 82.6; August, 81.9; September, 82.9; October, 82.8; November, 83.9; and December, 83.9. Percentage of humidity corresponds to rainfall. Largest in December and November, lowest in April and May. Range of humidity rather small during the year on account of the even distribution of rain. Mean maximum percentage 98 per cent, and the mean of the minimum 56 per cent. Therefore, the mean range of the average extremes of humidity is 42 per cent. The greatest amount of relative humidity recorded in Legaspi in eleven years is

100 in December, 1910, and the lowest is 43 per cent in August, 1908.

Plate I.



Temperature.—The average changes of temperature in Legaspi are taken from hourly observations as for the relative humidity: January, 25.7; February, 25.8; March, 26.5; April, 27.5; May, 28.1; June, 28; July, 27.1; August, 27.3; September, 26.6; October, 27.9; November, 26.4; and December, 26; mean 26.8. Lowest mean temperature in January. Coolest months, November, December, January, and February during the prevalence of northeasterly currents. Range of average monthly temperature 2.4 from January the lowest to May the highest. Highest recorded temperature in a period of eleven years, 37.2 in May, 1912; lowest temperature registered during the same period, 16.9 in February, 1905. Yearly mean maximum temperature, 32.5. Yearly mean minimum temperature, 21.8

SURIGAO

Rainfall.—The average monthly rainfall in Surigao for ten years is: January, 334 mm.; February, 400.2 mm.; March, 265.6 mm.; April, 271.6 mm.; May, 116.3 mm.; June, 114.2 mm.; July, 160.6 mm.; August, 90.4 mm.; September, 172.3 mm.; October, 238.4 mm.; November, 419.6 mm.; and December, 550.5 mm.; total, 3,133.7 mm.

There is no dry season in Surigao. Greatest rainfall in December. Most abundant rainfall in November, December, January, February, and March, owing to the prevalence of northerly and easterly winds. Less rain than in Legaspi during June, July, August, and September. Total average rainfall slightly less than that of Legaspi, owing to its position south and distant from the general track of typhoons which usually from June to September cross the Islands through higher parallels.

Cloudiness.—The monthly average amount of clouds is the following: January, 6.9; February, 7.5; March, 6.2; April, 6.1; May, 5.2; June, 5.9; July, 7.1; August, 6.4; September, 6.8; October, 6.2; November, 6.2; and December, 7.8; mean 6.5. Maximum amount of clouds in December as in Legaspi.

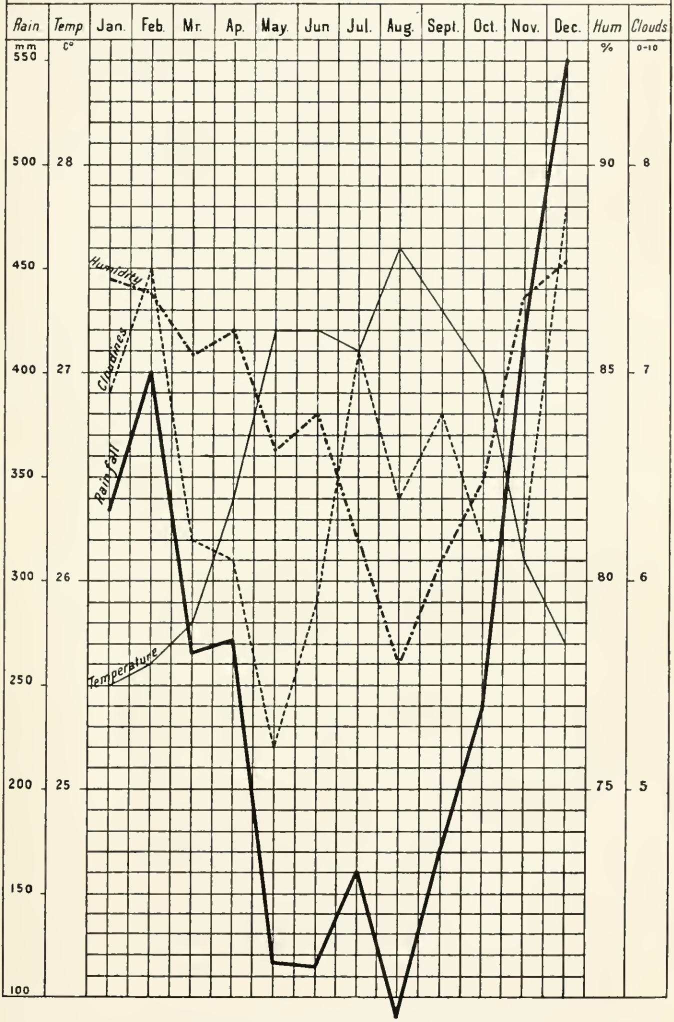
Humidity.—The monthly percentage of humidity runs as follows: January, 87.3; February, 86.9; March, 85.4; April, 86.5; May, 83.1; June, 84; July, 81; August, 78; September, 80.5; October, 82.4; November, 86.8; and December, 87.7; mean 84.1.

This monthly variation of the monthly percentage of humidity is taken from six daily observations during the last six years in order to make it more comparable with the results from other stations. There is a small range of humidity during the year. Maximum percentage in December due to maximum rainfall and maximum cloudiness. Minimum percentage in August corresponding to the small average of clouds and minimum rainfall with prevalence of light southerly winds. Mean of maximum humidity, 97.2

Plate II

CLIMATIC ELEMENTS-FIRST TYPE

SURIGAO



per cent; mean of maximum, 59.8 per cent; absolute maximum, 99 per cent in February, 1909, October and December, 1912, and in January and February, 1913; absolute minimum, 40 per cent in September, 1912.

Temperature.—The average monthly changes of temperature are: January, 25.5; February, 25.6; March, 25.8; April, 26.4; May, 27.2; June, 27.2; July, 27.1; August, 27.6; September, 27.3; October, 27; November, 26.1; December, 25.7; mean 26.5. Highest mean temperature in August, lowest in January, corresponding to the amount of rainfall. Mean of absolute maximum temperatures 33. Mean of absolute minimum 21.6. Absolute maximum recorded, 36 in July, 1913; absolute minimum, 18.5 in February, 1913.

The climatic conditions in Surigao are similar to those in Legaspi. There is a slight difference in the rainfall for the months of June, July, August, and September for the reason already given. The most important climatic elements of Legaspi and Surigao are graphically represented in plates one and two.

The distribution of rainfall being in the Tropics almost the controller of climate, we give in Table A the average monthly rainfall in all available places located in regions affected by the first type of climate.

From the observations of Legaspi and Surigao and from the foregoing table we may deduce the principal features of the first type of climatic conditions.

First. There is practically no dry season in this type of climate. The greatest amount of rain falls generally in December and January during the prevalence of northeasterly winds. In regions south of parallel 10° N., where the winds from west to south can not attain or do not attain usually great force or frequency, the rain, during the so-called typhoon season, is less abundant than during the prevalence of northeasterly or easterly winds in December, January, February, and March. The result is that there is generally an average rainfall for the year less in regions south of parallel 10° N.

Second. The percentage of the rainfall from October to February is nearly 50 per cent of the annual rainfall, and the percentage of rainfall from June to October never reaches 50 per cent of the rainfall for the whole year, especially in regions south of parallel 10° N.

Third. Cloudiness follows the distribution of rain. December and January, cloudy and rainy; the clearest months being April and May.

Fourth. The relative humidity has small range during the year, the percentage increases gradually from September to

TABLE A.—*Table of average monthly rainfall, first type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Atimonan	Luzon	216.5	135.2	78.5	96.4	158.2	143.8	229.0	156.1	306.9	386.5	446.4	358.5	2,712.0
Albay	do	233.5	168.2	229.0	155.4	188.3	207.6	266.2	242.1	299.8	212.5	301.0	457.0	2,960.6
Baler	do	259.2	122.0	189.0	329.1	300.1	239.2	318.8	162.5	326.7	336.9	345.6	372.8	3,301.9
Borongan	Samar	471.8	437.8	217.5	249.5	240.2	236.9	205.1	121.9	209.0	345.7	498.1	593.8	3,827.3
Butuan	Mindanao	181.5	244.1	147.6	122.0	126.5	151.1	129.6	98.9	136.2	162.9	287.9	317.5	2,105.8
Calbayog	Samar	144.3	178.2	103.1	107.9	166.6	146.9	200.1	188.0	287.9	255.5	284.6	261.8	2,324.9
Caraga	Mindanao	294.8	402.4	270.3	148.5	203.7	103.6	142.7	75.7	67.4	128.4	171.9	422.6	2,432.0
Dapitan	do	118.4	123.3	55.7	110.2	70.9	117.7	151.6	89.3	141.6	246.0	369.7	277.4	1,871.8
Gubat	Luzon	313.4	290.4	181.5	89.8	113.9	123.1	178.4	93.6	189.9	274.0	410.8	495.2	2,754.0
Laoang	Samar	429.6	379.9	260.0	117.0	97.3	162.2	257.4	84.3	174.7	267.6	510.5	545.0	3,285.5
Legaspi	Luzon	377.6	299.9	172.6	171.0	132.8	174.3	261.1	176.7	250.4	344.0	348.7	483.6	3,192.7
Maasin	Leyte	138.5	184.8	96.5	65.3	93.7	141.8	282.1	209.2	292.0	235.6	315.8	309.0	2,364.3
Nueva Caceres	Luzon	107.3	105.9	42.1	69.4	98.8	172.9	300.0	161.1	263.1	300.1	275.2	302.1	2,198.0
Ormoc	Leyte	176.7	100.7	78.3	65.8	72.8	177.2	324.9	288.0	308.5	257.5	219.6	180.7	2,250.7
Paracale	Luzon	313.0	285.1	257.7	103.6	148.5	158.2	480.1	190.8	236.0	564.9	424.0	369.4	3,531.3
San Antonio	do	190.0	106.5	122.9	107.4	170.4	195.1	275.6	267.6	362.8	355.4	380.6	338.5	2,872.8
Santo Domingo	Batanes	234.0	117.1	119.5	131.4	238.1	160.3	301.8	386.3	367.3	330.6	320.0	363.0	3,069.4
Surigao	Mindanao	334.0	400.2	265.6	271.6	116.3	114.2	160.6	90.4	172.3	238.4	419.6	550.5	3,133.7
Tacloban	Leyte	224.1	223.9	117.8	143.0	144.3	196.2	202.2	147.1	157.3	206.2	290.2	353.3	2,405.8
Virac	Catanduanes	167.8	263.9	147.5	134.2	135.1	196.9	318.0	110.0	162.3	287.5	398.7	406.1	2,727.7
Mean		246.3	228.5	157.6	139.4	150.8	166.0	249.3	167.0	235.6	286.8	350.9	387.9	2,766.1

December. Mean percentage for the whole year less than 85 per cent.

Fifth. The temperature of the Archipelago may be classified as of three kinds—high, intermediate, and mild. Regions of high temperature have a mean annual temperature greater than 27; those of intermediate temperature have an annual mean of less than 27; and in regions of mild temperature the average yearly mean is less than 26. Now, in regions of the first type of climatic conditions the mean annual temperature never exceeds 27 and consequently they enjoy either an intermediate or mild temperature.

The regions which enjoy climatic conditions like those of Legaspi and Surigao are north of parallel 10° N.

The southeast end of Luzon or the Provinces of Albay and Sorsogon.

The Province of Ambos Camarines and adjacent islands.

The Island of Catanduanes.

The eastern coast of Luzon from the seashore to the range of mountains in the Province of Tayabas, eastern Isabela, and the eastern Cagayan.

The northern and eastern coast of Samar and adjacent islands.

The San Bernardino Strait and adjacent islands.

The eastern coast of Leyte and adjacent islands.

Dinagat and Siargao and adjacent islands.

The small islands on the interisland sea between Panay and Luzon east of longitude 122° E. south of parallel 10° N.

The peninsula of Surigao to the mouth of Agusan River.

The eastern coast of Mindanao and the great valley of the Agusan River.

On the northern coast of Mindanao, the most northern parts of Misamis Province, and adjacent islands.

All these regions are easily accessible to wet currents direct from the Pacific.

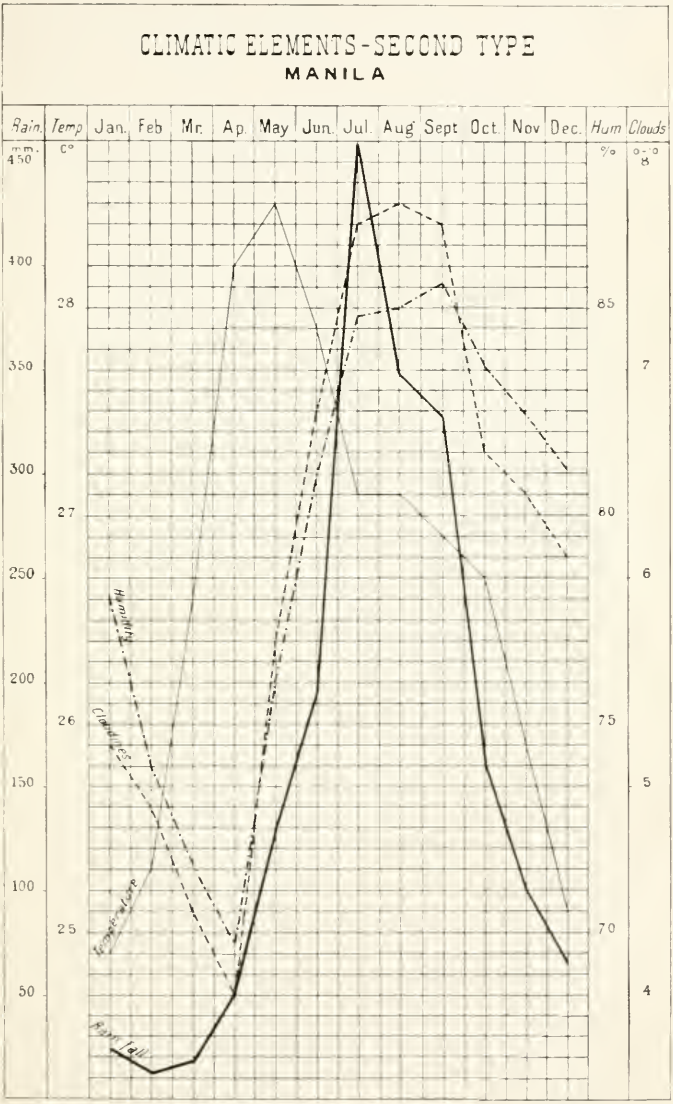
SECOND TYPE—MANILA AND DAGUPAN

MANILA

Rainfall.—The average monthly distribution of rainfall in Manila is (mean of forty-nine years): January, 24 mm., February, 11.9 mm.; March, 17.1 mm.; April, 50.2 mm.; May, 128.5 mm.; June, 193.8 mm.; July, 459.4 mm.; August, 347.1 mm.; September, 326.2 mm.; October, 162.7 mm.; November, 100 mm.; and December, 65.3 mm.; total, 1,886.2 mm.

There is a dry season in Manila lasting from December to April. Greatest rainfall in July and August. Driest months February and March. The rainfall of December is the greatest in the dry season, due to occasional frequency and prevalence of northeasterly currents over Manila. The abundant rainfall in June, July, August, September, October,

Plate III



CLIMATIC ELEMENTS-SECOND TYPE
MANILA

and November is caused either by cyclones or by electric storms or by both; most frequently the rainfall of April and May is due to electric storms.

Cloudiness.—The average monthly cloudiness in Manila for a period of thirty years is the following: January, 5.2; February, 4.9; March, 4.4; April, 4; May, 5.7; June, 6.8; July, 7.7; August, 7.8; September, 7.7; October, 6.6; November, 6.4; and December 6.1; mean, 6.1. Average cloudiness is increasing from April, where it reaches the minimum, to August, the most cloudy month. It decreases rapidly from September to April.

Humidity.—The percentage of the relative humidity in Manila for a period of thirty years is: January, 78.1; February, 74; March, 71.6; April, 69.7; May, 76.1; June, 80.9; July, 84.8; August, 85; September, 85.6; October, 83.6; November, 82.4; and December, 81.1; mean, 79.4.

Mean relative humidity is lower in regions of the first type on account of the prevalence of the dry season and the annual range of this element is greater than in the regions mentioned, for the same reason. Highest percentage of humidity in September, lowest in April. Absolute maximum of relative humidity recorded, 100; absolute minimum, 27 per cent, registered in May, 1912; absolute range for a period of thirty years, 73 per cent; average humidity of hottest months for a period of eleven years, 74.4 per cent; average of coolest months, 78.5.

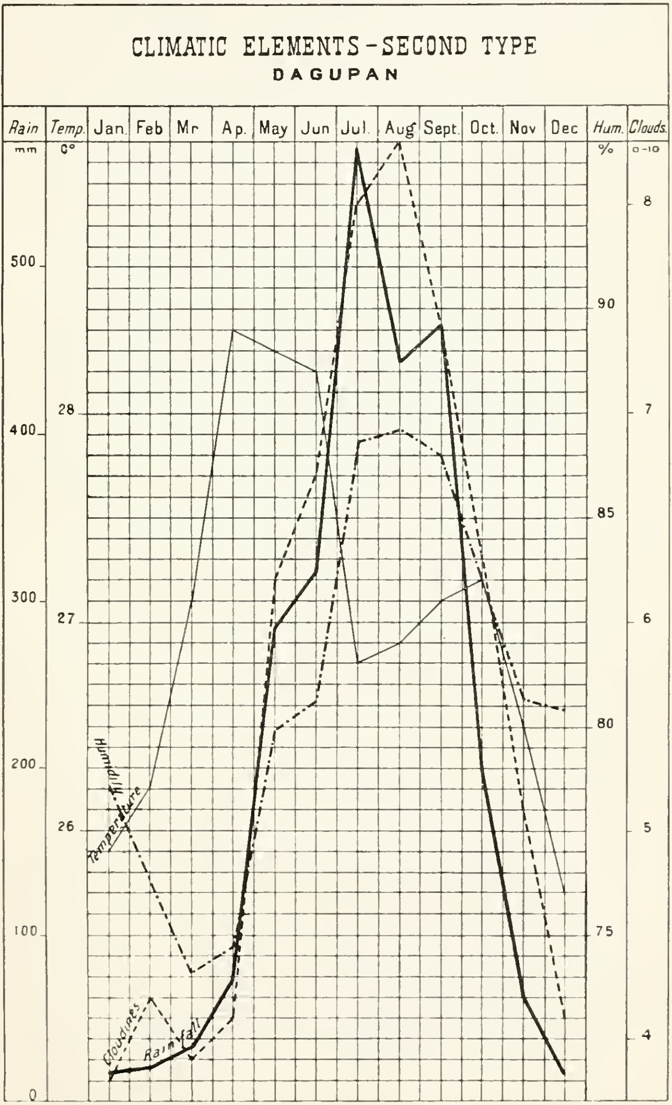
Temperature.—The average mean monthly temperature for a period of thirty years is: January, 24.9; February, 25.3; March, 26.6; April, 28.2; May, 28.5; June, 27.9; July, 27.1; August, 27.1; September, 26.9; October, 26.7; November, 25.9; and December, 25.1; mean, 26.7. Coolest months, January and February; hottest months, April, May, and June. Maximum temperature recorded in a period of forty-nine years, 39.7 in May, 1878; minimum registered, 12.1 in December, 1870, during the same period; absolute range of temperature for the period of forty-nine years, 27.6.

Monthly average of the maximum temperatures for a period of twenty-nine years: January, 30.1; February, 30.8; March, 32.4; April, 33.8; May, 33.5; June, 32.4; July, 30.9; August, 30.7; September, 30.6; October, 31.1; November, 30.3; and December, 29.9; mean, 31.4.

Monthly average of minimum temperatures: January, 20.4; February, 20.3; March, 21.3; April, 22.7; May, 23.9; June, 23.9; July, 23.7; August, 23.7; September, 23.6; October, 23.1; November, 22.2; and December, 21.2; mean 22.5. Average yearly range of extreme temperatures in Manila, 8.9.

Rainfall.—The monthly distribution of rainfall in Dagupan is: January, 10.7 mm.; February, 19 mm.; March, 30.2 mm.;

Plate IV



April, 72.8 mm.; May, 283.6 mm.; June, 317.6 mm.; July, 570.1 mm.; August, 442.9 mm.; September, 465.1 mm.; October, 198.8 mm.; November, 61.6 mm.; and December, 15 mm.; total, 2,541.4 mm. Average monthly rainfall lowest in November and December due to the absence of northeasterly currents and because the typhoon tracks by that time cross through lower parallels. This is the case in regions of the second type north of parallel 15°, as a glance at TABLE B will show. Slight precipitation in January, February, March, and April owing to the absence of easterly currents. Very abundant rainfall during June to October due to cyclonic and electrict storms and to the prevalence of southerly currents. Rainfall in May is almost exclusively due to electric storms.

Cloudiness.—The amount of clouds is distributed as follows: January, 3.8; February, 4.2; March, 3.9; April, 4.1; May, 6.2; June, 6.7; July, 8.0; August, 8.3; September, 7.4; October, 6.3; November, 5.1; and December, 4.1; mean, 5.4. Clearest sky in January due to the absence of easterly currents. Most cloudy months, August and September. Mean cloudiness similar to that of Manila.

Humidity.—The monthly percentage of relative humidity is: January, 78.6; February, 76.3; March, 74.1; April, 74.7; May, 79.9; June, 80.6; July, 86.8; August, 87.1; September, 86.5; October, 83.4; November, 80.7; December, 80.4; mean, 80.7.

Driest month, March; wettest, August and July. Maximum percentage, 100 during the rainy season; minimum, 28 in March, 1908. Range of percentage rather great due to the decided division of dry and wet seasons.

Temperature.—The average monthly temperature is: January, 25.9; February, 26.2; March, 27.1; April, 28.4; May, 28.3; June, 28.2; July, 26.8; August, 26.9; September, 27.1; October, 27.2; November 26.5; and December, 25.7; mean, 27.1.

Warmest month, April; coolest, December. Absolute maximum temperature in eleven years, 39.5 in May, 1906; minimum recorded during the same period, 14.3 in January, 1907, when there was a spell of cool weather over western Luzon; range of average monthly temperatures during the year, 2.5; absolute range of extreme temperature during the period mentioned, 25.2; mean daily range during January 16.9, during April 17.2, and during September 12.5.

We give in Table B the distribution of rainfall in the most important places located in the regions of the second type of climate.

TABLE B.—*Table of average monthly rainfall, second type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Arayat	Luzon	10.2	6.7	8.0	27.6	131.2	240.9	373.5	212.8	307.0	223.0	59.5	38.0	1,638.4
Baguio	do	37.9	15.4	38.9	116.3	447.1	403.4	1,003.2	1,027.9	864.8	456.7	90.1	54.4	4,556.1
Balanga	do	18.2	7.3	7.0	51.6	248.6	292.4	596.1	484.2	404.5	233.4	65.9	33.2	2,442.4
Batangas	do	16.8	23.4	7.5	28.3	124.7	96.8	306.6	171.3	293.2	183.1	214.0	99.1	1,564.8
Bolinao	do	10.1	12.7	13.2	45.4	254.2	395.7	776.1	622.0	523.3	177.9	48.5	15.7	2,894.8
Biñang	do	7.5	18.0	0.0	9.0	62.1	294.0	280.2	125.2	148.6	132.1	46.0	175.3	1,298.0
Cabo Santiago	do	6.5	0.2	5.7	4.6	99.4	186.9	368.2	239.9	321.5	120.8	101.6	57.5	1,512.8
Candon	do	4.7	6.4	11.7	13.4	232.0	334.2	686.3	548.4	488.6	186.2	53.1	12.9	2,578.2
Cavite	do	22.4	9.8	3.1	7.7	23.8	268.6	224.6	198.8	314.4	104.2	60.1	96.6	1,334.1
Corregidor	Corregidor	18.0	2.9	1.5	16.8	163.4	308.2	536.3	503.7	415.3	203.3	72.1	41.4	2,282.9
Cuyo	Cuyo	11.3	14.2	1.6	20.4	159.2	261.0	420.8	383.5	415.9	227.8	135.4	54.7	2,105.8
Dagupan	Luzon	10.7	19.0	30.2	72.8	283.6	317.6	570.1	442.9	465.1	198.8	61.6	15.0	2,487.4
Iba	do	10.7	5.9	37.8	73.6	302.8	382.8	1,130.2	947.0	832.4	175.9	35.5	17.5	3,952.1
Laoag	do	1.7	9.2	4.2	10.3	157.0	241.0	636.6	659.5	733.6	269.0	36.6	26.9	2,785.6
Mamburac	Mindoro	3.2	2.3	9.4	29.9	271.8	595.0	327.0	997.0	485.4	323.2	48.2	23.6	3,116.0
Manila	Luzon	24.0	11.9	17.1	50.2	128.2	193.8	459.4	347.1	326.2	162.7	100.0	65.3	1,886.2
Marilao	do	11.3	6.3	8.1	48.6	154.5	360.6	545.1	372.5	280.1	183.2	59.1	73.9	2,103.1
Masinloc	do	0.8	0.0	5.5	85.9	125.7	1,135.1	992.9	758.8	518.9	247.4	63.4	20.0	3,954.4
Olongapo	do	8.4	0.9	4.7	34.4	256.5	474.1	750.9	775.9	572.6	198.1	77.9	34.7	3,189.1
Porac	do	10.6	6.9	31.3	64.3	292.1	310.2	646.0	311.6	356.7	225.6	75.6	34.5	2,365.4
Punta Restinga	do	1.6	1.2	12.2	13.5	176.5	289.0	592.8	329.9	633.1	123.5	105.9	29.3	2,308.5
San Fernando Union	do	12.2	6.0	8.4	17.9	178.7	291.8	540.4	661.7	443.3	140.9	42.9	9.4	2,353.6
San Isidro	do	17.6	4.2	8.2	44.6	182.3	208.6	370.1	289.8	321.4	196.3	84.2	39.2	1,766.5
San Jose Buenavista	Panay	30.9	13.6	18.3	45.7	142.6	333.4	587.7	517.2	546.5	316.6	180.7	59.7	2,792.9
Silang	Luzon	39.3	20.4	23.1	55.2	177.5	242.2	477.1	377.0	351.8	179.3	147.4	120.4	2,210.7
Tarlac	do	7.5	9.6	21.9	65.8	185.7	224.2	418.8	339.4	350.6	191.4	81.7	42.5	1,939.1
Vigan	do	0.4	3.1	5.8	32.7	218.8	347.9	699.6	719.3	579.4	185.2	20.2	9.5	2,821.9
Mean		13.1	8.8	12.8	40.2	191.9	334.4	567.3	495.0	455.3	206.1	80.3	48.2	2,453.4

The principal elements of the climate of Manila and Dagupan are shown graphically in Plates III and IV.

From the observations of Manila and Dagupan and from Table B we may deduce the most important climatic conditions of the second type.

First. There is a distinct wet and dry season in this type, the dry lasting generally from the end of November to March.

Second. The percentage of rainfall during the months from June to October, popularly called the "rainy season," is at least 76 per cent of the total precipitation of the year, while the rainfall from November to February never exceeds 12 per cent of the total average. May and April are apt to have more precipitation than the dry months, owing to electric storms, and occasionally, especially in May, to cyclones.

Third. Amount of clouds follows precipitation or rather shows the average precipitation. Clearest months from January to April, cloudiest months September, August, and July.

Fourth. The annual percentage of humidity is not very high owing to the influence and duration of the dry season. Annual percentage is not more than 80 per cent. The range of the monthly percentage is considerably greater, while the average for the year is less than in regions of the first type.

Fifth. The temperature in these regions is either high or intermediate, seldom or never mild, according to the classification made above.

The regions which have climatic conditions similar to those of Manila and Dagupan are:

The western coast of Luzon from Cape Bojeador to Cape Santiago or the Provinces of Ilocos Norte, Ilocos Sur, Union, Zambales, Bataan, and Batangas.

The Provinces of Rizal, western Bulacan, Pampanga, Nueva Ecija, Tarlac, and Pangasinan, the Lingayen Gulf, and adjacent islands.

The western coast of Mindoro and adjacent islands.

The western coast of Panay.

The islands in the north Sulu Sea and north of Paragua.

The Palawan and adjacent islands.

These regions are far distant from the Pacific ocean or they do not get the influence of the currents from that ocean except through considerable portions of land.

THIRD TYPE—APARRI AND CEBU

APARRI

Rainfall.—The average monthly rainfall is: January, 186.1 mm.; February, 81 mm.; March, 47.6 mm.; April, 47.8 mm.; May, 122.3 mm.; June, 142.1 mm.; July, 205.8 mm.; August, 246.9 mm.; September, 298 mm.; October, 329.7 mm.; November, 304.4 mm.; and December, 241.8 mm.; total 2,253.5 mm.

The largest amount of rainfall occurs from September to January; maximum fall in November, minimum in March. Precipitation diminishes as the wind veers to the east from January to March and then an imperfect dry season, very short, occurs, in March or April. Rain less abundant than in regions of the first type during the prevalence of easterly winds, but more abundant than in the regions of the second type during the months of February, March, and April, especially in the interior and western part of Mindanao, except the Zamboanga Peninsula and Basilan with the adjacent islands.

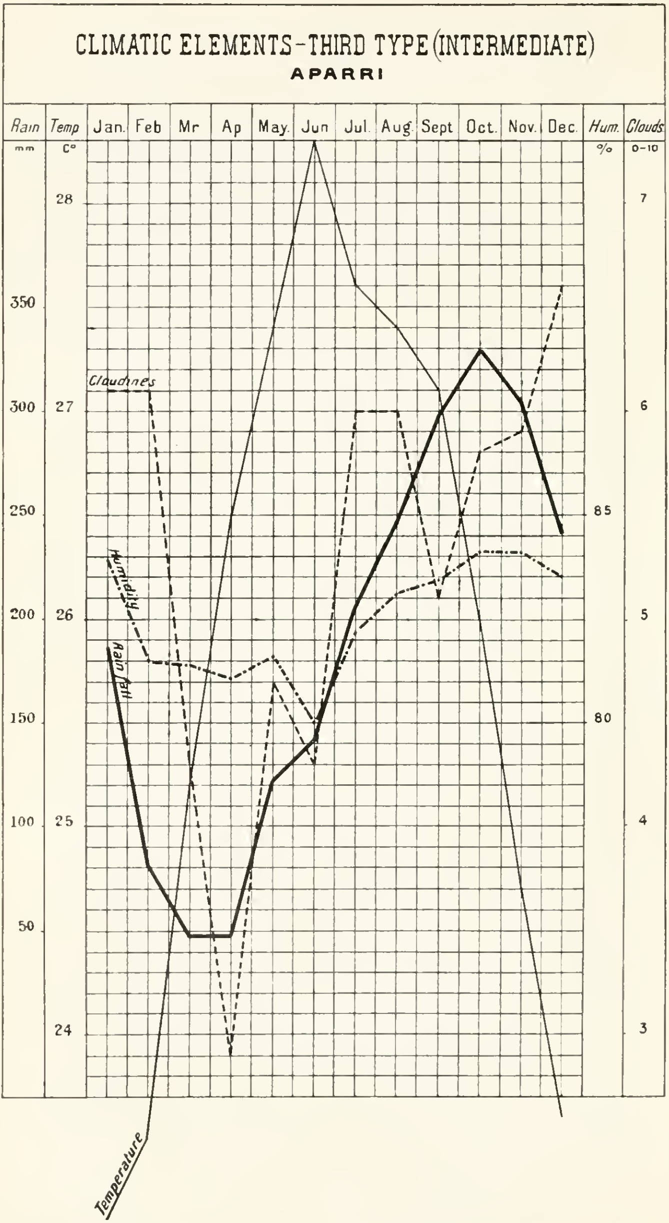
Cloudiness.—The amount of clouds agrees with the distribution of rain. January, 6.1; February, 6.1; March, 4.3; April, 2.9; May, 4.7; June, 4.3; July, 6.0; August, 6.0; September, 5.1; October, 5.8; November, 5.9; and December, 6.6; mean, 5.3. Clearest sky in April, cloudiest in December. Amount of cloudiness generally less than in regions of type first and second. Range of cloudiness greater as a consequence. Average similar to regions of the first type north of parallel 10° N.

Humidity.—The mean monthly humidity is as follows: January, 83.9; February, 81.5; March, 81.4; April, 81.1; May, 81.6; June, 80; July, 82.2; August, 83.1; September, 83.4; October, 84.1; November, 84.1; and December, 83.5; mean, 82.5.

The percentage of humidity is higher than in regions of the first type with smaller range during the year. The average mean monthly maximum, 96.7 per cent; the average mean monthly minimum, 57 per cent; the average daily range of humidity 40 per cent. The greatest percentage of relative humidity recorded in a period of six years, 99 per cent in June, 1909, and in February, 1913; lowest, 45 per cent in February, 1910, and in March, 1912.

Temperature.—The average monthly temperature in Aparri is: January, 23.1; February, 23.5; March, 25.2; April, 26.5; May, 27.4; June, 28.3; July, 27.6; August, 27.4; September, 27.1; October, 26; November, 24.7; and December, 23.6; mean 25.8. Coolest month, January; warmest, June.

Plate V.



CLIMATIC ELEMENTS–THIRD TYPE (INTERMEDIATE)

APARRI

Range of monthly mean temperature during the year, 5.2; average daily range of temperature during February, 14.2; average daily range in July, 12.2° C. Yearly mean maximum temperature 31.6° C.; yearly mean minimum temperature, 21.5° C.; range of the extreme mean temperatures, 10.1° C.; highest recorded temperature in eleven years, 37.8° C. in May, 1903; lowest registered temperature during the same period, 15.5° C. in February, 1905; absolute range of temperature, 22.3° C.

CEBU

Rainfall.—The average rainfall per month in Cebu is: January 93.3, mm.; February, 76.7 mm.; March, 47.2 mm.; April, 38.8 mm.; May, 87.5 mm.; June, 167.6 mm.; July, 185.1 mm.; August, 136.1 mm.; September, 179.8 mm.; October, 219.4 mm.; November, 162.2 mm.; and December, 149 mm.; total, 1,542.7 mm.

Very short dry period, as in Aparri, lasting practically only one month, April. Largest amount of rain in July, mostly due to cyclonic storms. Rain increasing with northeasterly winds from October to November and December, moderating in January, February, and March, as the winds veer to southeast. Rainfall less than in Aparri in July, August, September, and October due to its position south which is more distant from cyclonic tracks during that period. Total rainfall less than in types first and second.

Cloudiness.—The average amount of clouds per month is: January, 4.7; February, 5.2; March, 4.3; April, 4.0; May, 4.8; June, 5.4; July, 6.1; August, 5.7; September, 5.9; October, 5.6; November, 5.3; and December, 5.4; mean, 5.2.

Amount of clouds in Cebu agrees very closely with that of Aparri, the distribution, however, is slightly different, the maximum corresponding to July as the rainfall and the minimum to April. The range of cloudiness is less in Cebu than in Aparri. The sky is much clearer in Aparri than in Cebu in April, but just the reverse during December and January, owing to the lesser influence of northeasterly winds in Cebu.

Humidity.—The percentage of the relative humidity in Cebu is: January, 76.1; Fberuary, 77.2; March, 73.5; April, 73.4; May, 74.2; June, 75.7; July, 76.7; August, 76.5; September, 77.5; October, 78.9; November, 78.2; and December, 78.3; mean, 76.2. The percentage of humidity is higher in October, November, and December owing to the influence of northeasterly and easterly high currents, the driest month being April. There is a very small range of humidity during the year owing to the short dry season. Cebu is generally dryer than other places more directly exposed to winds from the Pacific. Currents from the Pacific reach Cebu through Samar and Leyte islands and the passage overland modifies the hygrometric conditions of the air.

Temperature.—The monthly mean temperatures are: January, 26; February, 26; March, 26.6; April, 27.5; May, 28; June, 27.8; July, 27.1; August, 27.3; September, 27.1; October, 26.8; November, 26.5; and December, 26.2; mean, 26.9. Average coolest months, January and February; absolute minimum temperature recorded in fourteen years, 18.3 in February, 1905; absolute maximum registered during the same period, 34.9 in June, 1912; absolute range of temperature for the period mentioned, 16.6. Yearly mean maximum temperature for a period of eleven years, 30.9; yearly mean minimum for the same period, 23.3; average range of temperature during the year, 7.6° C.

We give in Table C the average distribution of rainfall during the year in places of the third type.

The changes of the most important climatic elements in Aparri and Cebu are graphically represented in Plates V and VI.

From the observations of Aparri and Cebu and from Table C we may deduce the climatic conditions of the third or intermediate type:

First. There is a short period of dry season in the regions of this type, lasting one or two months, generally between January and April, according to the more or less prevalence of wet easterly currents over the place, controlled mostly by the distance from the Pacific. We may consider as dry a month with less than 50 mm. rainfall. Average total rainfall for the year is less than 2,000 mm.

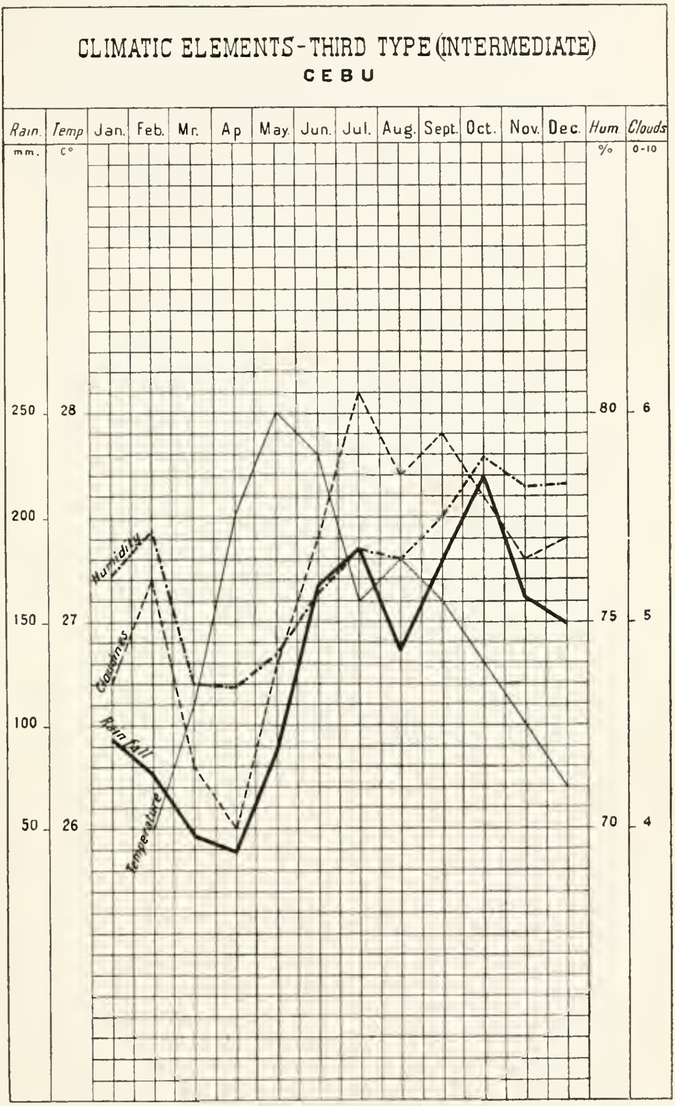
Second. The percentage of rainfall from November to February is less than 20 per cent of the total precipitation for the year. Percentage for the months of June to October very seldom exceeds 60 per cent.

Third. Cloudiness follows the amount of rain, which seems to be uniform during the year except for a short period of less rain; so that the clearest month is, as an average, the least rainy month. The average amount of clouds is less than over the regions of the first type.

Fourth. The relative humidity is lower than the regions of this type south of Luzon. However, the average percentage of each month oscillates in the same manner as the rain.

Fifth. The temperature in this type is generally intermediate on the seashores and high inland where, of course, the altitude above the sea level is below 80 meters. It is mild in the most northerly regions, as in the Batanes and

Plate VI.



Babuyanes islands and in northern Luzon on the seashore, as Aparri, and also over the small islands of that type, south, TABLE C.—*Table of average monthly rainfall, third type*

Station.	Island.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Aparri	Luzon	186.1	81.0	47.6	47.8	122.3	142.1	205.8	246.9	298.0	329.7	304.4	241.8	2,253.5
Bacolod	Negros	111.2	63.9	15.3	24.5	138.6	236.0	413.5	305.2	302.1	256.8	116.2	186.5	2,172.8
Balingasag	Mindanao	75.2	51.7	25.6	21.3	47.8	177.8	241.0	179.0	274.4	225.9	253.6	86.2	1,659.5
Bayombong	Luzon	34.8	29.5	37.6	70.0	164.1	77.2	153.0	124.5	178.0	132.9	107.3	77.3	1,186.2
Calapan	Mindoro	90.1	84.0	87.2	137.4	182.0	231.3	292.2	107.2	207.5	289.2	325.3	195.6	2,229.0
Capiz	Panay	145.5	109.5	23.9	53.9	187.8	297.7	379.6	260.2	324.1	507.7	288.6	262.3	2,840.8
Cagayan	Mindanao	21.5	31.9	46.6	44.5	98.6	169.1	145.5	196.4	217.8	182.7	116.1	168.3	1,439.0
Cebu	Cebu	93.3	76.7	47.2	38.8	87.5	167.6	185.1	136.1	179.8	219.4	162.2	149.0	1,542.7
Cotabato	Mindanao	98.8	88.8	68.1	168.9	218.5	237.3	292.0	271.8	248.6	255.1	231.7	133.5	2,313.1
Davao	do	110.2	141.6	164.2	190.3	252.8	234.2	208.9	207.3	203.6	242.3	176.4	208.8	2,340.7
Dumaguete	Negros	35.3	96.6	14.7	18.8	57.6	167.3	189.7	86.8	123.8	174.6	120.8	53.3	1,139.3
Echague	Luzon	43.6	43.4	40.5	80.4	160.8	105.2	169.7	203.4	175.9	221.2	233.1	142.0	1,639.2
Iloilo	Panay	53.6	29.4	30.2	47.0	131.9	208.7	485.5	363.3	329.7	268.2	208.4	141.7	2,297.6
Isabela	Basilan	54.4	89.2	58.2	89.2	108.0	210.6	208.4	205.8	201.6	261.7	168.4	138.6	1,794.1
Jolo	Jolo	89.1	122.4	85.2	118.2	160.2	203.3	172.0	170.4	184.4	222.9	193.0	144.8	1,865.9
La Carlota	Negros	59.7	55.6	47.4	87.0	229.3	304.8	358.7	378.6	392.9	350.9	199.0	127.3	2,591.2
Masbate	Masbate	133.0	160.5	49.3	45.4	74.1	120.4	217.2	127.3	195.8	137.6	201.4	185.8	1,647.8
Romblon	Romblon	106.9	68.0	49.3	53.7	122.2	161.1	320.8	153.6	194.2	305.7	296.8	227.2	2,059.5
Santa Cruz	Luzon	64.4	47.3	38.1	48.4	131.8	145.0	306.2	289.3	267.2	245.7	183.8	123.9	1,891.1
Tagbilaran	Bohol	83.7	110.7	71.8	194.7	106.7	136.8	292.7	122.5	175.4	281.0	193.9	165.1	1,935.0
Tamontaca	Mindanao	61.4	50.2	128.0	82.8	191.2	312.3	224.8	200.6	293.8	136.5	151.2	76.6	1,909.4
Tayabas	Luzon	135.1	42.2	60.2	23.8	99.3	83.8	96.6	73.9	116.5	239.0	283.2	195.4	1,449.0
Tuburan	Cebu	112.3	67.5	40.9	9.9	59.9	130.7	148.5	99.6	178.1	170.0	153.0	114.5	1,284.9
Tuguegarao	Luzon	32.2	22.2	36.1	74.9	135.4	137.0	265.1	215.9	324.8	287.6	303.1	162.3	1,996.6
Zamboanga	Mindanao	37.2	62.0	21.0	38.2	72.0	88.8	99.0	95.0	106.3	116.1	106.5	84.3	926.4
Mean		82.7	73.0	53.4	72.4	133.6	179.4	243.7	192.8	227.8	242.4	203.2	151.7	1,856.2

as Jolo, and along the seashores benefited by the straits' currents, as Isabela of Basilan, Zamboanga, and Surigao; finally on the western coasts of Samar and Leyte.

The regions which enjoy this type of climate are:

The Batanes and Babuyanes groups.

The extreme north of Luzon.

The Cagayan Valley of Luzon with the slopes east of the Sierra Madre down to Caravallo Sur.

Shores around the Laguna Bay.

Masbate and the islands of the interisland seas.

The northern and eastern coast of Panay.

The islands of Negros, Cebu, and Bohol.

The Gulf of Davao.

The western coast of Mindanao and the south end of the Zamboanga Peninsula. The banks along the Pulangui or great Mindanao River.

These regions are somewhat distant from the Pacific Ocean, and if they are exposed to currents from northeast or east, these currents are modified by the influence of intermediate islands and are not so apt to bring condensation or precipitation.

Climates and agriculture.—The difference of the distribution of rainfall in the various parts of the Archipelago which constitutes the basis for the division of climates in the Philippines is also the principal factor in the diversity of the agricultural products which are or may be obtained in the Islands. By taking advantage of the natural resourses only, some products can be obtained more advantageously in some parts than in others; but by making use of artificial means of irrigation, it is possible to obtain practically all tropical products in one and the same region because the influence of the tropical temperature is uniform enough in all the islands, while the distribution of rain varies greatly in the different epochs of the year and even from year to year in one and same region.

Products such as hemp (abacá), which require a uniform distribution of rain throughout the year without a dry season, grow well in the regions of the first type. Products such as sugar, tobacco, coffee, and cacao, which can resist a short dry season, may be grown with advantage in the regions which have the third type of climate;[1] tobacco can also be grown in the regions of the second type, if the dry season is not of long duration, while with the aid of artificial irrigation the principal products like sugar, tobacco, coffee, and cacao may be obtained in regions of the second type.

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[1] As far as sugar is concerned we may confirm this statement with the experience in a sugar land in the Tropics (West Indies), the island of Barbados. In 1874 Sir R. W. Rawson, governor of the British colony at Barbados, published a colonial report, giving an elaborate study of the dependence of the cane-sugar crop upon the monthly and annual rainfall. Barbados offers an exceptional opportunity for such study, and its latitude

Rice may be and, as a matter of fact, is grown in all the types of climate or in all the islands; it also does very well, especially by duplicating the crops, in regions of the third type and in the other types the crops may be increased by irrigation.

Coconuts do well in all the types of climate, but especially in the first and third.

Apart from this, the variety of the products may be greatly increased in the highlands and even nontropical fruits may be harvested, except fruits such as apples, pears, prunes, etc., which do not bear fruit abundantly because in all three types

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being about 13° N., the results are comparable with those in the Philippines. Moreover, the number of rainfall records averaged more than one to a square mile being 178 for the whole island and for a period of about twenty-five years. "The influence of the rainfall," says Mr. Rawson, (Rawson's Report, p. 33) "in particular months and seasons upon the coming crop is generally felt and admitted, but not known with any certainty. It is believed, writes an experienced agriculturist, that any marked excess of rain during the first six months of the year is injurious both to the crop that is being reaped and to that which is to follow. In ordinary and favorable years, with light showers during the first six months, the young canes make no marked progress, but the roots are increasing in length and strength, and in the months of July and August the plant begins to sucker, as it is called, and to put out the shoots which form the canes, but these make no great progress in length before the end of August and in September and October, when the rains usually come to their aid at the critical time. Then they grow with extreme rapidity, are extremely tender and succulent, and a short spell of dry weather at that time usually does serious mischief. If, however, the first six months of the year are wet, and the young canes are excited to an abnormal rapidity of growth, they are liable to be seriously affected by any interval of dry weather in the middle of the year." These conditions of rainfall distribution seem to be the features of the average monthly rainfall in the third type of climate in the Philippines. In fact, by taking only the rainfall in twelve years of good sugar crop in Barbados out of twenty-five years, we find the following average monthly rainfall: January, 94 mm.; February, 56.1 mm.; March, 36.6 mm.; April, 56.4 mm.; May, 97 mm.; June, 147.3 mm.; July, 142.8 mm.; August, 191.8 mm.; September, 142 mm.; October, 214 mm.; November, 179.3 mm.; and December, 119.6 mm.; total, 1,477.7 mm.

By comparing this result with the mean average distribution of rainfall corresponding to the third type of climate in the Philippines, as given in Table C, we find: First, the total rainfall is greater in the Philippines and this is rather favorable to sugar production; second, the distribution of rainfall seems to be more suitable to cane development as the amount of rain during the first six months of the year in the Philippines in only 22 per cent of the total annual rainfall, while in Barbados is 33 per cent; finally, more abundant rains occur in the Philippines in July, August, September, and specially in October, which are the critical months, the sugar crop being benefited by it.

of climate there are periods which have an amount of rain in excess of what these plants can bear.

Hence, the highlands of Abra, Bontoc, Benguet, and Tayabas in Luzon, of Mindoro, the tablelands of Bukidnon, of the high Agusan, Pulangui, and Lanao, and of the Lakes Siguasan, Butuan, and Cebu, recently discovered, are excellent for a great variety of tropical and nontropical agricultural products.

Cyclones.—Exposure with more or less frequency to tropical cyclones of a country can make it more or less desirable, so it will be interesting to say, at the end, a few words on the way these storms affect the different regions of the Archipelago. Unfortunately, all the regions of the three types of climate are exposed to cyclones and their frequency depends mostly on the latitude of the place. As a matter of fact and as the result of long years of experience, we may briefly say that the southern part of the Archipelago up to 8° latitude N. is nearly free from cyclones, as these storms are rare there and number only about 5 per cent of the storms that cross the Archipelago. It makes the agricultural lands of nearly the whole of Mindanao exceedingly valuable. From 8° N. to about 11° N., of over a zone 180 miles wide, the cyclones are a little more frequent or about 10 per cent of the storms which visit the Islands; this leaves nearly undisturbed the great sugar lands of Negros and southern Panay. From 11° N. to 13° 30′ N. the cyclones are very frequent and often destructive and are about 30 per cent of the cyclones affecting the Archipelago. North of that zone there is another zone more than 100 miles wide less visited by cyclones as they are only 20 per cent of the cyclones for the year. Finally, the northern part of the Archipelago up to Formosa is the most visited by cyclones. About 35 per cent visit that region. In the map Plate A we show graphically the different zones affected by cyclones and their frequency.

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THE PHILIPPINE ISLANDS

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Sanitary Achievements in the Philippine Islands, 1898-1915

Smallpox and Vaccination in the Philippine Islands, 1898-1914

Leprosy in the Philippine Islands

Written December, 1914, for the Panama-Pacific International Exposition, San Francisco, California, February 20, 1915—December 4, 1915

BY

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MANILA, P. I.

JUNE, 1915

Sanitary Achievements in the Philippine Islands, 1898-1915

Written for the Panama-Pacific International Exposition, San Francisco, California, February 20, 1915, to December 4, 1915.

By

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Manila, P. I.*

The United States of America may well be proud of the results attained along the lines of sanitation and hygiene by her sanitarians in the Philippines during the past sixteen years, especially when it is known that these have been achieved with the expenditure of about 10 cents per capita per annum.

There is no doubt but that, from a sanitary standpoint, the Philippines today are far in advance of most other Oriental countries and in fact of many states in the home country.

It is impossible in a publication of this size to do more than touch upon a few of the more important lines of work and the results obtained.

ORGANIZATION.

When, on August 13, 1898, the United States assumed control of the Philippine Islands, the former city authorities were asked to turn over the sanitary service and records of vital statistics, but it was found that beyond an appropriation of $4,800.00 for municipal physicians and medicines for the poor and $2,000.00 for a municipal laboratory in Manila, no such service existed, nor had any compilation of vital statistics been made. It became necessary, therefore, to establish a health organization that would meet the needs of the situation.

To this end Brigadier-General Hughes, U. S. A., on September 29, 1898, issued an order which created a Board of Health for the City of Manila under the provisions of which the city was divided into ten sanitary districts and a native physician placed in charge of each, whose duties included the medical care of indigents, the reporting of insanitary conditions and dangerous communicable diseases, the investigation of causes of deaths, and the furnishing of certificates of death in all cases where death occurred without medical attention.

In addition to the ordinary functions of a Board of Health, the Board exercised general supervision over charitable institutions, prisons, and a hospital for venereal diseases, and directly supervised the vaccine plant, municipal laboratories (which the Board organized), free dispensary, and hospitals for leprosy, smallpox and plague.

Eight municipal midwives were employed, but it was a difficult matter to induce the people to avail themselves of their services. A plan is now under way to operate a Training School for Midwives in connection with the Nurses' Training School at the Philippine General Hospital. By this means it is hoped to supply the Islands with about 200 trained women per year.

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*A portion of the data and certain statements were taken from the annual reports of the Bureau of Health for the Philippine Islands.

Previous to this time the registration of vital statistics was in charge of the parochial priests. The Board at once undertook the work of securing and compiling vital statistics, and required the registration of physicians, pharmacists and dentists. Comprehensive laws have since been passed which created examining boards for the professions named, and registration is granted after passing examinations that compare favorably with those held in the United States.

The more prevalent diseases encountered at this time were smallpox, leprosy, malaria, dysentery and diarrhoeas.

LEPROSY.

Leprosy was found to be widely distributed, the Franciscan priests estimating the total number of lepers in the Islands at 30,000. This estimate was entirely too high, as it is probable that less than 10,000 cases existed in 1898.

The necessity for the segregation of lepers was recognized and efforts made to inaugurate and carry the plan to a successful issue, but many obstacles were encountered, and beyond the isolation of a limited number of cases at San Lazaro Hospital in Manila and two similar institutions in the provinces, nothing definite was accomplished until May 1906, when the present colony at Culion was opened. To date more than 8,000 lepers have been segregated at Culion, and the present number of colonists exceeds 3,400, the majority of whom are quite well satisfied with their lot. It is believed that hereafter the number of cases encountered outside the colony will gradually diminish.

MALARIA.

Malaria among the soldiers stationed at several points outside of Manila at once became a troublesome problem, but by forcing them to sleep under mosquito nets, and by the liberal use of quinine the disease became less and less prevalent. Gratifying results have since been obtained by the filling of stagnant pools or, if this could not be accomplished, by the use of crude oil and other sanitary measures. Within the past year quinine has been placed on sale with the municipal treasurers of the provincial towns, and this very useful drug may now be secured at a nominal rate. Formerly as high as 10 cents per 5 grain tablet has been charged in some of the more remote towns.

BUBONIC PLAGUE.

Bubonic plague appeared in Manila on December 29, 1899, and was almost continuously present to some extent until April 1906, after which no further cases occurred until June 19, 1912, when a fatal case occurred. During the remainder of the year 49 cases were reported, the year 1913 produced a total of 20 cases, and during the first nine months of 1914 there were 26 cases, at the end of which time it was believed to be eradicated. The city of Manila has passed an ordinance prohibiting the erection of buildings with hollow walls or ceilings, and this will do much toward the elimination of the rat and consequently of the plague carrying flea.

BERIBERI.

Beriberi formerly caused hundreds of deaths annually in Government institutions. After extended research it was found that the use of polished rice as the main article of diet bore a direct relationship to the incidence of the disease. The Governor-General on May 4, 1910, issued an executive order prohibiting the use of polished rice in Government institutions, and the effect of the substitution of unpolished for polished rice was very soon apparent.

During the year 1908 a total of 244 deaths from beriberi were registered at the Culion Leper Colony. For the two years ended June 30, 1914, during which time unpolished rice was furnished, a total of 3 deaths from this disease occurred. At Bilibid Prison similar results were obtained. It is probable that the few deaths registered were in the advanced stage of the disease at the time of admission to these institutions.

ASIATIC CHOLERA.

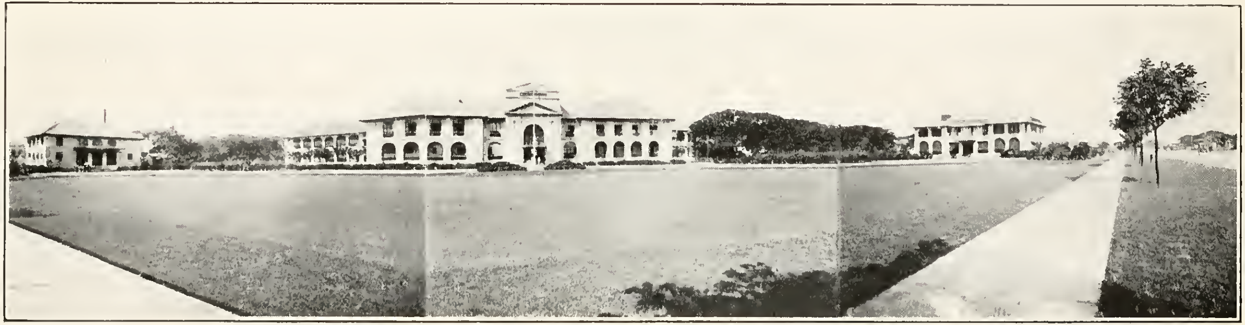
Cholera has caused as many as 100,000 deaths in one year in the Philippines. The prompt and efficient isolation of cases and carriers, and thorough disinfection of all fomites and of the house and the adjoining ground where infected material was thrown and the proper disposal of faeces and vomited matter have made it possible to hold the disease in check with a reasonable degree of certainty. Hundreds now die of the disease where formerly thousands died.

HOSPITALS.

Outside of Manila a few hospitals were found, the majority of which were constructed of bamboo and nipa palm leaves and were entirely devoid of sanitary accommodations.

At the present time there are three modern Government hospitals in the provinces, the materials and equipment for one of which had to be transported by hand to an elevation of about 3,000 feet over narrow mountain trails. Four smaller and less modernly equipped hospitals are also maintained by the Government in provincial towns, while others are under consideration. A number of mission and private hospitals are to be found in the provinces.

In Manila the hospital facilities were found to be extremely inadequate. During March, 1901, a "Women's Hospital" was opened, and on August 6, 1901, the Philippine Commission passed a law making it incumbent upon the Government to render medical assistance to its employees. To meet this requirement the Civil Hospital was opened during October of the same year. This institution, in connection with the San Lazaro Hospital for the care of dangerous communicable diseases, met the needs of the Government for a time, but it soon became apparent that additional hospital facilities were a necessity. Finally, on September 1, 1910, after a period of



THE PHILIPPINE GENERAL HOSPITAL, MANILA, P. I.
The most modern hospital in the Orient.

THE NEW DISPENSARY AT THE PHILIPPINE GENERAL HOSPITAL, MANILA.

More than 60,000 persons are treated here annually.

nearly ten years of effort and planning, the Philippine General Hospital opened its doors to the public. This institution has a capacity of about 375 beds and is so planned that it may, by the pavilion system, be increased to a 1500 bed hospital. It is believed to be the best and most modern hospital in the Orient.

San Lazaro Hospital, already referred to, is utilized for the care of all classes of dangerous communicable diseases and the insane. Plans are now under way to build a modern insane asylum just outside of Manila.

In addition to the Government institutions, there are five other fair-sized and several smaller hospitals in Manila, some of which the Government assists in maintaining.

WATER AND SEWER SYSTEMS.

Water and sewer systems were practically unknown and no attempt was made properly to dispose of human or other wastes. A large part of such wastes, even in Manila, were thrown into the streets and hogs and chickens acted as scavengers.

At the time of American occupation of the Islands, Manila derived its water supply from the Mariquina River, the Pasig River, and from wells and cisterns. The main supply came from the first-named river, which has its source in the mountains some ten or twelve miles from Manila. After flowing through three towns, which used the river as a common dumping ground and for bathing and washing purposes, the water was pumped into two subterranean reservoirs, hewn out of a soft white rock, which were ventilated by means of numerous cupolas. One reservoir had a capacity of 6,300,000 gallons, and the other 8,200,000 gallons. The city was supplied by gravity but, on account of the low elevation and small mains used, in some sections the pressure was practically nil.

Examination of the water showed it to be at all times dangerous for domestic use, and at one time it showed as many as 613,703 bacteria per cubic centimeter.

AN OLD INSANITARY SURFACE WELL AT PASIG, RIZAL.
A dangerous water to drink.

The total connections to the system on August 31, 1902, numbered 3,329, of which only 1,825 were private connections. The population of the city at this time was about 220,000, hence a very small percentage of the people were availing themselves of the doubtful benefits of the system.

In view of the fact that the capacity of the *deposito* amounted to only a two days' supply of water for the city and of the vitally important fact that the water was a constant menace to the public health, it was realized that a purer and more adequate supply was an imperative necessity.

This was finally secured on November 12, 1908, when the present supply was made available. The watershed of the Mariquina River was cleared of its 10,000 inhabitants and a dam constructed across a gorge at the outlet, thus providing a natural reservoir with a capacity of 50,000,000 gallons. The pipe line to the city is capable of supplying 22,500,000 gallons daily, and in an emergency the old reservoirs can be utilized to supply an additional 15,000,000 gallons. A total of 7,227 private connections have been made and 258 street hydrants are available for those who cannot afford to pay for the necessary connection.

The pressure of the new system is 40 to 55 pounds to the square inch, the reservoir being 140 feet above the datum level of the city. The pipe line is 42 inches in diameter and 10½ miles long. The total cost was about $2,000,000.00.

In the provinces the water supply was secured largely from rivers and shallow surface wells, oftentimes without walls and the opening flush with the ground level. It is not surprising, therefore, that the death rate was often as high as 50 per thousand per annum. Efforts were made, with more or less success, to improve the water supply by encouraging the people to use only the better class of wells and to discontinue

ARTESIAN WELL, CALOOCAN, RIZAL.
A safe water for domestic use.

the use of river water. No satisfactory results were obtained, however, until the drilling of artesian wells was begun in 1905. Rapid strides have been made along this line, and at the present time more than 1000 of these wells are in operation. Their use has resulted in a marked diminution in the number of cases of intestinal parasites and other intestinal disorders.

The average death rate for the provinces during the year 1913 was 21.53 per 1000 inhabitants, and the artesian wells may safely be accredited with a fair percentage of this highly gratifying reduction in the provincial mortality rate.

Fairly satisfactory results have been obtained by the treatment of waters containing amoebae with calcium hypochlorite.

SEWER SYSTEMS.

Measures were at once adopted to minimize the dangers arising from the lack of sewer facilities, and on August 22, 1901, the Board of Health passed a resolution which provided for the establishment of a sanitary pail conservancy system for night soil. This system, together with the old insanitary septic vaults, was used until the completion of the present sanitary sewer system in Manila, which was begun during the fiscal year 1907 and completed May 25, 1909, at a cost to the Government of about $1,650,000. Fifty-two miles of sewer pipes were laid in order to give a satisfactory system to the city as a whole. This installation easily ranks with the best to be found in the Orient. The maintenance cost amounts to about $75,000 per annum.

The sewers range in diameter from 7.874 inches to 5 feet 8.9 inches, and the slopes are sufficient to warrant a velocity of not less than 25.59 inches per second when flowing one-half full. The minimum depth is 4 feet 11 inches, and the maximum depth is 17 feet 8.6 inches.

Five substations are required to give the system the flow mentioned above, and are located as follows:

	Gallons per 24 hours.
Ermita, with a capacity of	5,000,000
Santa Cruz, with a capacity of	12,000,000
Quiapo, with a capacity of	5,000,000
Malate, with a capacity of	2,000,000
Paco, with a capacity of	800,000

These pump the sewage to the main pumping station, which is located on the beach in the lower part of Tondo and has a capacity of 25,000,000 gallons for twenty-four hours. The main station has a lift of approximately 28 feet 10.45 inches, and discharges into the bay, through a 3 foot 5.34 inch cast-iron force main laid 10 feet below the bed of the bay, at a point approximately 1 mile from the shore. This pipe terminates in a vertical position, which was done for the purpose of making the discharge take place above the bottom of the bay. The outlet end is encased in a huge block of cement masonry which rests upon a timber platform supported by a group of piles.

Branches or outlet pipes have been provided at intervals of 39.37 feet throughout practically the entire sewer system. The system is ventilated by omitting the vent pipe and continuing the soil pipe and vent pipe of each house connection through and above the roof. Flush tanks with suitable connections to the water system supply have been constructed at the ends of the primary lateral sewers for the purpose of keeping them clean and in a satisfactory condition. These tanks have been built to hold about 349 gallons of water each, and are provided with gates and handles for operation by hand. This feature is unique and has been introduced for the first time in Manila.

The pumping plant consists of centrifugal pumps driven by electric motors, and are supposed to be automatic, the rise and fall of the sewage in the sewer starting or stopping the pumps as occasion may require.

MOATS.

A massive stone wall as a protective measure was begun around old Manila in 1571 and completed during the eighteenth century. On the outside of and surrounding this wall was a moat which had degenerated into a swamp or morass covering 25 acres of ground. A number of private house drains emptied into it and carabao wallowed in its mud and slime. Inasmuch as there was only a slight circulation of water, it was in a very filthy condition and afforded an ideal breeding place for myriads of mosquitoes.

This whole area has now been reclaimed by filling in and at present is covered with a well kept lawn and affords ideal grounds for athletic sports.

MARITIME QUARANTINE.

Sixteen years ago maritime quarantine as enforced in the Islands was ineffective. Dangerous communicable diseases were frequently introduced without concerted efforts being made to prevent their importation.

A very efficient service was established and is maintained by the United States Public Health Service.

One of the most modern quarantine stations in the world has been constructed at Mariveles, Bataan Province, which is situated at the entrance to Manila Bay, about 30 miles from Manila.

A similar but smaller station is located at Cebu for the convenience of vessels which desire to enter one of the southern ports.

These stations have on numerous occasions prevented the introduction of dangerous communicable diseases into the Philippines.

DEATH RATE IN MANILA.

The death rate in Manila among the 4,412 Americans for the fiscal year 1913 was 8.42 per 1,000 and for Americans in the Government service it was 2.47 per 1,000. These figures show that even after making due allowance for the fact that the Government employees were selected only after a satisfactory physical examination, the expectancy of life for Americans is quite as good in Manila as in the United States.

GENERAL CONDITIONS.

Fifteen years ago the Philippine Islands were unenviably known from a sanitary standpoint. Today they are setting the pace along many lines for the countries most advanced in the science of sanitation.

The temperature in the lowlands ranges from about 65 to 98 degrees Fahrenheit, while in the mountains the extremes are about 35 and 80 degrees Fahrenheit.

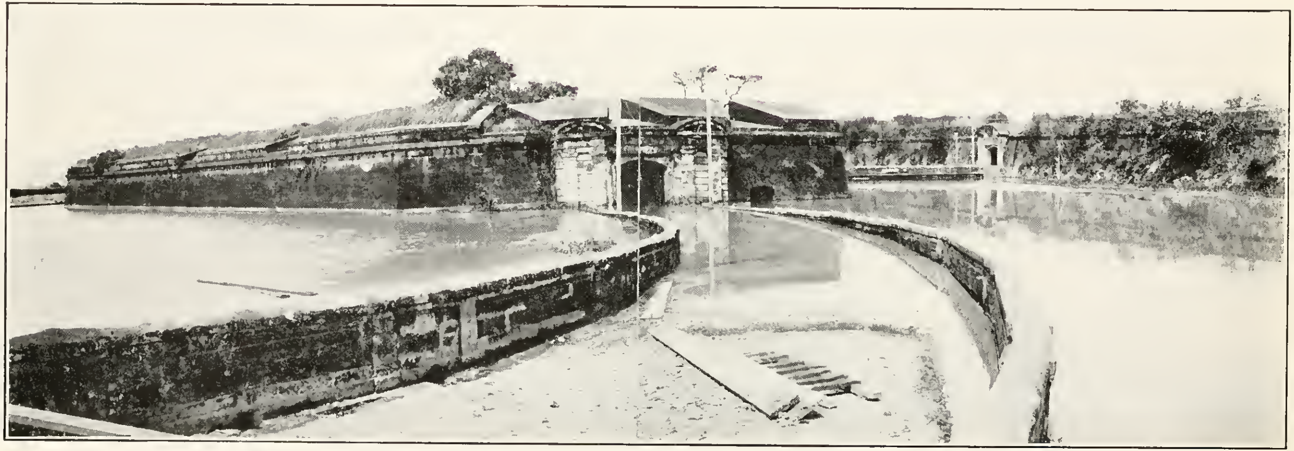
The average Manila rainfall during the so-called dry season amounts to about 14.7 inches and during the wet season to about 44.8 inches.

It will be seen, therefore, that a low temperature, which is of great aid to the sanitarian in temperate zones, does not exist in the Philippines. Insects thrive at all seasons of the year.

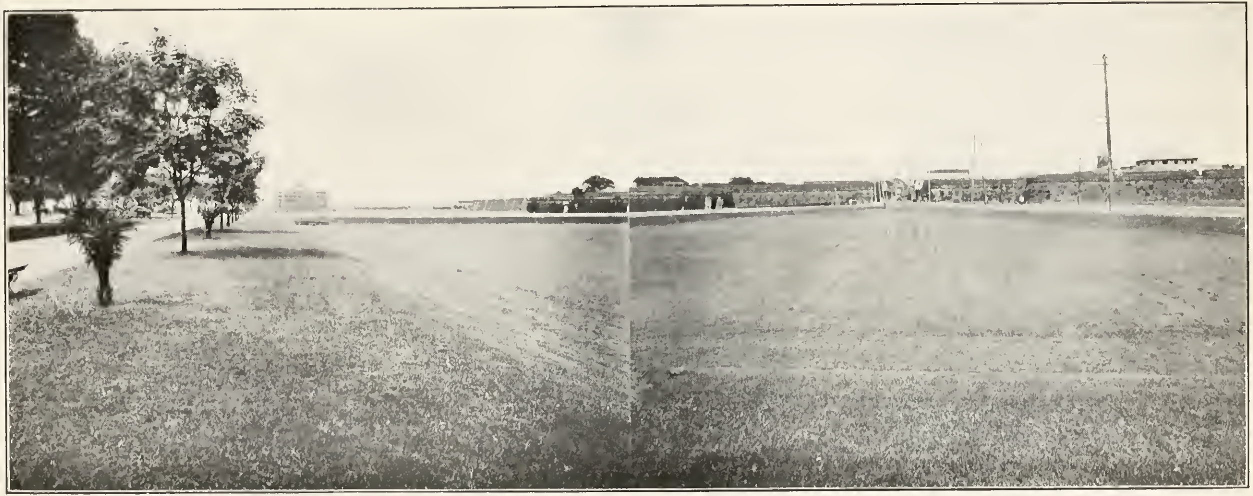
Fifteen years ago there were in Manila about 31 miles of esteros, or canals, which were in many instances extremely filthy. They have been in part filled up, and the remaining ones have been dredged out so that the water flows in and out with the tide; in some instances they have been walled up, so that instead of constituting a nuisance they now serve as useful arteries of commerce.

Formerly no provision was made for the care of the insane; they were of necessity often tied up when intractable. At present two institutions in Manila are open to this class of patients, and a project is under way to build a modern asylum just outside of Manila.

The Government operates a plant in Manila that is capable of producing 100,000 pounds of ice and 5,000 gallons of distilled water daily. These products are sold to the public at the nominal rates of 4/11 of 1 cent per pound for ice, and about 1 cent per quart for water delivered. The plant also provides extensive cold storage facilities.



SECTION OF THE OLD INSANITARY MOAT AROUND THE WALLED CITY OF MANILA.
Now beautiful sunken gardens.



SUNKEN GARDENS, MANILA.
Formerly an extremely insanitary moat. Now used for athletics.
Manila Hotel in background.
Shows Gral Luna entrance to the Walled City and Aquarium.

INSANITARY SECTION OF MANILA IN 1908.
Many blocks of this type of houses have been removed.

Several other ice plants are in operation in Manila and a number of the larger provincial towns are provided with plants. Ice is also shipped by rail from Manila to many of the towns reached by the railroad lines.

Bulletins on the subject of sanitation and hygiene are issued by the Bureau of Health from time to time. Some of these are taught in the 3,500 or more public schools as well as by members of the sanitary organization throughout the Islands.

More than 300 provincial boards of health have been organized and are doing missionary work along sanitary lines.

The functions of the Bureau of Health are much more comprehensive than is implied by the title, since its duties include

RIZAL AVENUE, MANILA.
This street was formerly one of the most insanitary in the city.

not only the compilation of vital statistics and the safeguarding of the public from dangerous communicable diseases, but embrace the administration of public charities, the care of the insane, orphans and the infirm, the administration of general and special hospitals, the hygienic and medical care of all Government employees, the sanitary control of cigar and cigarette factories; it acts in a semi-missionary capacity in connection with the organization of Government units among the wild tribes, and in short comes in contact with the majority of the activities of the Archipelago.

Modern antituberculosis measures have been adopted and hospitals for the care of this disease opened. At Baguio, which has an elevation of nearly 5,000 feet, uniformly good results have been obtained in the fresh air treatment of the disease.

Smallpox and Vaccination in the Philippine Islands, 1898-1914

By

DR. JOHN E. SNODGRASS,
Assistant to the Director of Health.
MANILA, P. I.

It is probable that in no other way have the results obtained by sanitarians in the Philippine Islands since American occupation been more satisfactorily or conclusively demonstrated than by vaccination for the prevention of smallpox.

Sixteen years ago the annual deaths from smallpox in the Islands were very conservatively estimated at 40,000. During the year 1913 a total of 823 deaths were reported, none of which occurred in Manila.

What is responsible for this almost unbelievable reduction in the death rate from this dread disease? The answer is that about 18,000,000 vaccinations have been performed in the Philippines during this length of time.

The military authorities began the work of vaccinating throughout the country as fast as it became opened up. The reports of the chief vaccinator under the Spanish regime show that from November 3, 1894, to October 25, 1898, when the municipality of Manila was transferred to the administration of the United States, a total of 9,136 vaccinations were performed. During the year 1899 a total of 103,931 vaccinations were performed in Manila alone, notwithstanding the fact that the authorities deemed it inadvisable to permit forcible vaccinations on account of the probability of creating a lasting prejudice against this very necessary measure.

The necessity for systematically vaccinating the population of the entire archipelago soon became apparent. This was made possible by Act. No. 309 of the Philippine Legislature, which was passed on December 2, 1901, and made vaccination compulsory. The work was begun in 1903, and the following table shows the progress of the campaign:

Province.	Date of Beginning.	Date of Completion.	Total Vaccinations.
City of Manila	Jan. 1903	Dec. 1904	306,169
Cagayan	July 1904	July 1905	121,155
Cebu	July 1904	Nov. 1906	563,599
Isabela	Dec. 1904	Mar. 1905	67,488
Rizal	Jan. 1905	Sep. 1905	97,808
Romblon	Apr. 1905	Apr. 1905	21,343
Cavite	Apr. 1905	Apr. 1906	97,528
Union	Apr. 1905	Nov. 1906	128,256
Ilocos Norte	May 1905	Sep. 1906	164,136
Bataan	Sep. 1905	Dec. 1905	34,834
Ilocos Sur and Abra	Sep. 1905	Apr. 1906	212,195
La Laguna	Oct. 1905	June 1906	126,062
Batangas	Dec. 1905	Dec. 1906	257,502
Pampanga	Jan. 1906	June 1907	165,669
Oriental Negros	Mar. 1906	Mar. 1907	132,790
Ambos Camarines	Sep. 1906	Apr. 1908	260,481
Bohol	Oct. 1906	Jan. 1908	264,002
Occidental Negros	Oct. 1906	May 1909	90,926
Bulacan	Nov. 1906	May 1908	221,119
Capiz	Nov. 1906	May 1909	370,505
Zambales	Dec. 1906	Feb. 1907	55,730
Sorsogon	Jan. 1907	Jan. 1908	128,366
Tayabas	Jan. 1907	Oct. 1907	195,132
Lepanto-Bontoc	Jan. 1907	May 1908	39,901
Iloilo	Jan. 1907	June 1909	819,286
Pangasinan	Mar. 1907	Oct. 1907	435,638
Nueva Ecija	Apr. 1907	June 1908	136,734
Tarlac	May 1907	Jan. 1908	155,679
Albay	July 1907	May 1908	254,948
Surigao	Jan. 1908	Dec. 1908	96,452
Misamis	Jan. 1909	Mar. 1910	130,900
Mountain	Feb. 1909	May 1909	23,190
Antique	June 1909	Mar. 1910	96,341
Mindoro	Jan. 1910	Apr. 1910	35,525
Leyte	May 1910	Apr. 1914	584,969
Agusan	June 1910	Feb. 1911	35,259
Samar	Oct. 1913	June 1914	*104,997
Moro (not yet systematically vaccinated).			
Total systematic vaccinations			7,032,614

In addition, non systematic vaccinations to the number of about 11,000,000 have been made which bring the grand total up to, in round numbers, about 18,000,000.

In carrying on the work of systematic vaccination it has been customary to employ groups of 20 to 50 native assistant sanitary inspectors, each of which was placed under the supervision of a physician or an American sanitary inspector. The towns of a province were vaccinated in geographical order, and the itinerary so arranged that a number of the vaccinators would return to a vaccinated town a week or ten days subsequently and inspect the vaccinations. Certificates were given to persons obtaining a positive result, while those showing no result were revaccinated.

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*Vaccinations still continue.

The same procedure has, in part, been followed in making the non systematic vaccinations, the exception being that towns in which an outbreak of smallpox was reported were first visited.

The law provides that all district health officers shall semi-annually cause to be vaccinated all unvaccinated persons or those not recently vaccinated, in their respective districts.

Opposition to vaccination among the natives and even among a certain percentage of Americans was at first very marked, especially in the remote provincial towns. This antipathy has been largely overcome and the semi-annual vaccinations are taken as a matter of course.

It has so happened that now and then one of the misguided, American anti-vaccinationists has managed to evade vaccination and has paid dearly for his folly.

The deaths reported throughout the Islands from smallpox during the past 5 years are as follows:

During the year 1909	6,212 deaths.
During the year 1910	3,044 deaths.
During the year 1911	1,192 deaths.
During the year 1912	567 deaths.
During the year 1913	823 deaths.

During this period no deaths from the disease have been reported in Manila.

Were it possible to carry out the provisions of the compulsory vaccination law, it is absolutely certain that the disease would disappear from the Philippine Islands.

The virus used is all manufactured by the Government laboratories in Manila and is put up in the moist form in 100 unit tubes, which amount, if properly conserved, is sufficient for 100 vaccinations.

The method commonly employed in performing a vaccination is as follows:

(1) Cleanse the site with a pledget of cotton saturated with alcohol and allow to dry.

(2) Place a small amount of virus on the spot to be scarified, using the lancet end of the vaccinating instrument after sterilization to convey the virus from the tube to the arm.

(3) A five point scarifier is ordinarily used to introduce the virus. Care is used not to draw blood. The instrument is sterilized by passing it through a flame.

(4) Allow the virus to dry.

(5) No dressing is applied.

Despite the efforts that are often made to wash off the virus or to render it inert by the application of washes, herbs, etc., almost no ill effects are noted, which indicates that the virus furnished is of excellent quality.

The following experience of the writer will illustrate how trivial a matter will sometimes interfere with the success of such a campaign.

While vaccinating the province of Cebu, during which campaign over 200,000 persons were vaccinated, it was noted that many people were hiding and that considerable difficulty was experienced in persuading others to submit to vaccination. This experience was repeated in two or three towns. Finally the municipal president of one of the towns explained the cause of the difficulty. The virus used at this time was put up in amber colored glass tubes, while that previously used had been supplied in clear tubes. It appeared that a man in one of the towns had made the statement that the new virus was poison as it was not the same color as the old. The story quickly spread from town to town, and the result was that many people hid in the woods and in many instances children and babies were found in boxes, cupboards and similar hiding places.

One of the greatest difficulties encountered in carrying on the work in provincial towns is that the glycerinized virus will not retain its potency for more than a week or ten days if not kept on ice. In many remote municipalities more than a week is required to transport it to these towns, and as it is often carried by foot messengers, over rough mountain trails, it is impossible to transport heavy ice chests.

Persistent effort has been made to secure an efficient dry virus but without any encouraging degree of success to date. Several lots of such a virus have been made at the Government laboratories, and while one lot or one tube would be satisfactory, the results obtained from the next would be negative.

The percentage of successful vaccinations with the Government virus in previously unvaccinated persons varies, but will average from 60 to 70 per cent.

The only argument necessary to explode the theories of the anti-vaccinationists is to compare the visages of the children of today with those of their parents. Very few of the former are disfigured from smallpox, while a comparatively large percentage of the latter bear the scarred faces, and only too often the loss of sight or other disfigurements, which formerly were so common as a sequel to smallpox in the Islands.

It will be a difficult matter to convince an unbiased judge that a measure that has reduced the number of deaths from smallpox in the Philippine Islands from over 40,000 to a few hundred per annum in the space of 16 years is not a meritorious one.

Leprosy in the Philippine Islands

By

DR. JOHN E. SNODGRASS,
Assistant to the Director of Health,
Manila, P. I.

It is stated on reliable authority that leprosy was introduced into the Philippine Islands in 1633. It appears that the Emperor of Japan sent a ship with 150 lepers on board, as a present, to be cared for by the Catholic priests. They were allowed to land and as no practical measures were taken to prevent the spread of the disease, it steadily increased until 1906 when the Culion Leper Colony was opened.

During the Spanish regime there was a division of authority between the Church and the State, and in the matter of health measures and vital statistics it appears that the Church assumed the major part of the responsibility.

Leper institutions were conducted by the Church along charitable lines, more for the purpose of aiding individual sufferers than with the view of preventing the spread of the disease.

The first leper hospital was established in Manila in 1633, on what is now Calle Concepcion, by the Franciscan order as a part of their general hospital which had been in operation since 1603. A comparatively small number of lepers were cared for in this institution until 1784, with the exception of a few years between 1662 and 1681, when they were removed to a safer place because of a threatened invasion by Chinese pirates.

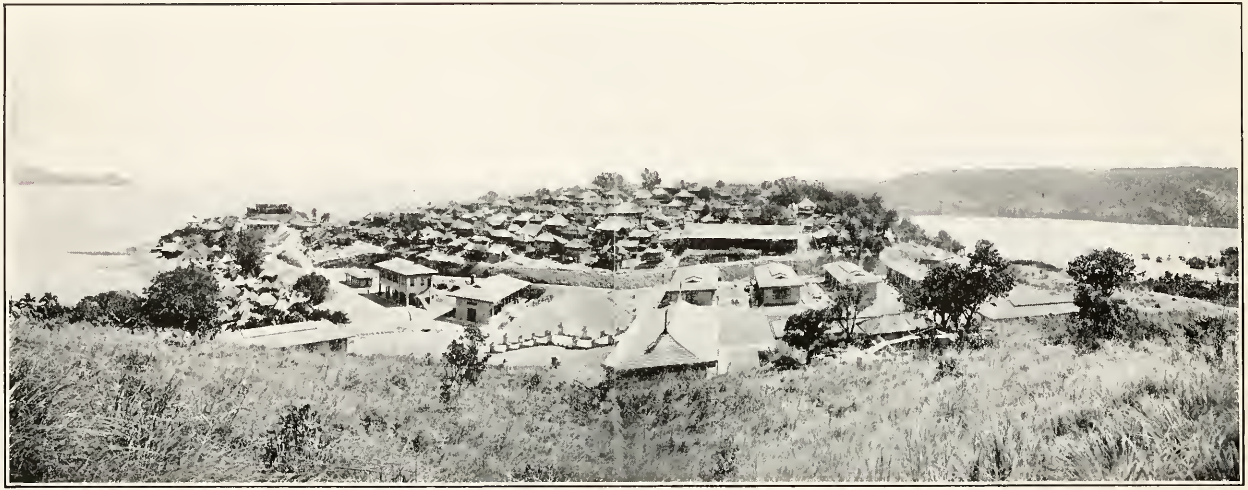
In 1784, upon the expulsion of the Jesuit order from the Islands, the Spanish Government took possession of the present San Lazaro Estate and transferred it to the Franciscans, who built a leper hospital on a portion of the estate at a cost of about $13,770.00. They called the institution San Lazaro Hospital and this building with a number of additions constitutes the present Government institution, designated by the same name, for the care of dangerous communicable diseases in Manila.

The hospital was abandoned on August 12, 1898, the day before the surrender of the city to the American arms, as the priests considered it unsafe to remain outside the Walled City, and the hospital was found practically empty after the occupation took place. The lepers were gradually returned to the institution as they were apprehended.

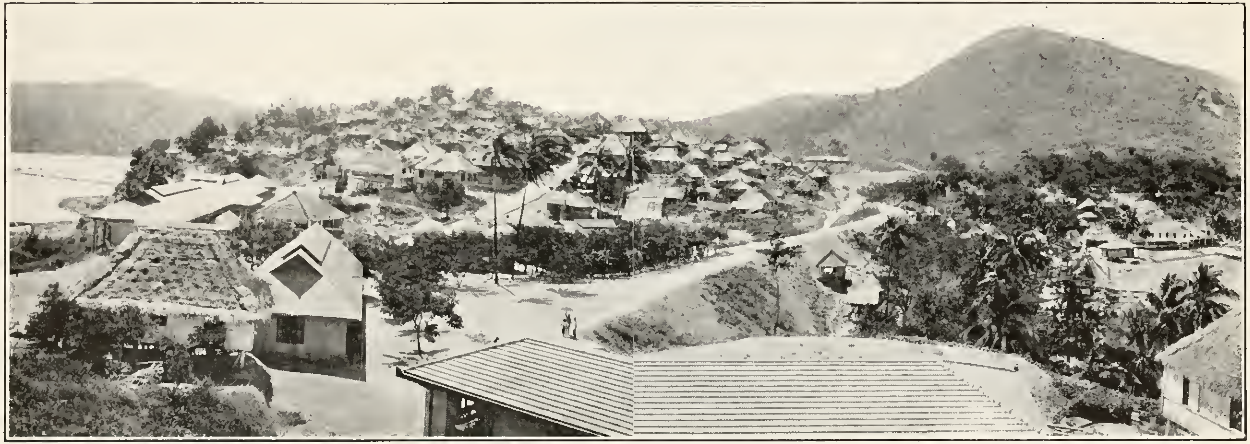
At this time two other leper hospitals existed at Cebu, Cebu, and the Palestina Hospital at Naga (Nueva Caceres), Ambos Camarines, respectively.

The combined capacity of the three institutions was about 500.

It will be seen, therefore, that little or no effort had been made toward the segregation of the leper population.



VIEW OF A SECTION OF CULION LEPER COLONY,
November, 1914.



A SECTION OF CULION LEPER COLONY.
View from the Church, November, 1914.

The Board of Health took up the question of isolating these unfortunates, and considerable time was spent by a committee composed of the Secretary of the Interior, the Commissioner of Public Health and the Sanitary Engineer of the Bureau of Health in examining proposed sites for a leper colony. Finally, on January 1, 1902, Halsey Harbor on the west coast of Culion Island was decided upon as a suitable location and it was the intention to begin the construction of a colony there at once, but an outbreak of bubonic plague in Manila required the presence of the Sanitary Engineer, which necessitated the postponement of building operations until January 1903. A great deal of difficulty was experienced in securing labor and after several months it was decided that the site did not afford a sufficient water supply for a colony of the proportions necessary and it was abandoned during the month of September 1903, in favor of the present location on the northeastern coast of the island, which was formerly the town of Culion.

The property of the inhabitants was purchased by the Government and out of the 67 structures comprising the town those that could be utilized were retained and a sufficient number of others erected from bamboo and nipa to meet the immediate needs of the situation.

On May 28, 1906, lepers from Cebu, Cebu, to the number of 365 were landed at the colony, thus forming the nucleus of Culion Leper Colony, which is now widely known as the largest and one of the best institutions of its kind in the world.

The Chief of the colony had been stationed at the colony for some time prior to the arrival of the first colonists, making arrangements for their coming in order that they might be made comfortable at once. The Chief at first lived across an arm of Culion Bay some two miles distant from the colony proper, but later on moved to the employees' section, about one-eighth mile from the colony.

The colonists are not permitted to pass a specified point which is known as a dividing line between the colonists' and the employees' sections.

There have been three chiefs of the colony since it was opened. The Chief is the executive officer of the colony, the quarantine officer for Culion, and ex-officio Justice of the Peace. He is not infrequently called upon to act in the latter capacity as at times there have been as many as 500 non-leprous employees upon construction work at the colony and many of them have their families with them, consequently the population of Culion has been as high as 3,600 persons, and disputes occasionally arise.

The Chief, who according to law must be a physician, is assisted by another doctor whose duties consist of the actual medical and surgical care of the lepers.

Four Sisters of Charity of the Order of St. Paul de Chartres and one Jesuit priest were stationed at the colony to assist in caring for the lepers on their arrival. The former have been increased in number to 8, and 2 priests now minister to the spiritual needs of the colonists. The sisters assisted by both male and female leper helpers, selected because of previous experience or adaptability, do all the nursing and surgical dressings for the colony. Frequently there are more than 250 patients in the hospital at one time, and as many as 350 surgical dressings for out-patients are sometimes done during one morning.

For a number of years the lepers were permitted to elect their own president and councilmen, and ordinances passed by them were submitted to the Chief, who either approved or vetoed the measures as seemed advisable. During 1910 the only American leper at the colony was, by popular vote, elected president. This plan has been discontinued and an advisory council appointed, executive power being vested in the Chief, the Director of Health and the Secretary of the Interior.

For a number of years difficulty was experienced in apprehending lepers, as their friends would secrete them when a collection trip was to be made. Latterly much less opposition has been encountered, and not infrequently persons having friends or relatives at the colony or those having various skin diseases resembling leprosy present themselves and ask to be taken to Culion, the latter class stating that they are outcasts in their home towns. It has been a pleasure to be able to relieve many such cases by treatment and to give them certificates stating that they are not lepers and thus restore them to society.

GOVERNMENT CUTTER, "BASILAN,"
The leper collecting steamer, at the pier, Culion Leper Colony.

Leper collecting trips are made about twice yearly. About three weeks before a trip is to be made the District Health Officers are notified to segregate all the lepers in their districts at a convenient port,—nearly all of the provinces having a seaport. A steamer of about 100 tons capacity is ordinarily

ADMINISTRATION BUILDING, CULION LEPER COLONY.
Located in the employees' section.

used to collect the lepers. A bacteriologist from the Government laboratories accompanies each expedition and examines all suspects. No case is taken unless positive microscopically, with the exception of a few of the clinically positive ones having the anaesthetic form of the disease, it being a difficult matter to demonstrate the bacillus in the purely anaesthetic type without resorting to a nerve section. Cases clinically positive and microscopically negative are examined on the occasion of a subsequent collection and are usually found to be positive.

At the colony a leper police force numbering 15 to 18 is maintained to preserve peace in the colony. They are of great aid to the Chief and render comparatively easy what would otherwise be a difficult situation to meet. When on duty they wear a regulation uniform of khaki, except that on special occasions white is worn. The Government pays them a small salary for their services.

Paid leper sanitary inspectors are of great aid in maintaining the colony in a sanitary condition. A non-leprous native sanitary inspector of the Bureau of Health is in charge of the force under the direction of the Chief of the Colony.

A brass band of about 16 pieces greets newcomers to the colony and gives concerts on special occasions. A string orchestra possessing considerable merit furnishes the necessary music for dances, receptions, etc.

An attractive concrete theatre has been constructed, where the colonists enjoy moving pictures, phonograph concerts, dances and receptions. This building has no walls and is in effect an open air theatre. In case of a driving rain, another nearby hall furnishes a suitable substitute.

Athletic meets are occasionally held and a great deal of interest is manifested in baseball. That they possess the true American baseball spirit was demonstrated at one of the games when both teams attacked the umpire with ball bats.

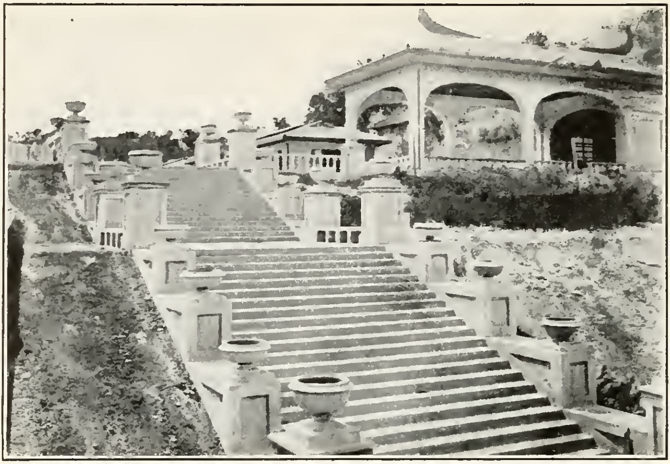
Many of the lepers spend a large part of their time in fishing from rafts made of 6 or 8 pieces of bamboo, 3 or 4 inches in diameter, lashed together. It is not solely a pastime, for the Government pays them at the rate of nearly 4 cents per pound for as many fish as they can catch. A catch of 25 pounds or more in a day for one man is not infrequent.

The Government pays a weekly gratuity of 10 cents to the colonists in addition to providing them with quarters, if they are unable to procure bamboo and nipa to build their own, part of the necessary clothing, and subsistence. The gratuity is paid with a special, aluminum, colony currency which is worth face value in the colony. All money, mail or other effects from the colony are disinfected before leaving Culion.

All leper employees on permanent detail are paid a small monthly salary, and a variety of ways of earning money permits the colonists to accumulate considerable sums.

Since 1906, lepers have been transferred to Culion as follows (readmissions not included):

1906—Second quarter	365
Third quarter	132
Fourth quarter	305
1907—First quarter	1
Second quarter	310
Third quarter	221
Fourth quarter	158
1908—First quarter	1,025
Second quarter	150
Third quarter	257
Fourth quarter	171
1909—First quarter	396
Second quarter	499
Third quarter	198
Fourth quarter	285
1910—First quarter	122
Second quarter	180
Third quarter	229
Fourth quarter	399
1911—First quarter	173
Second quarter	268
Third quarter	0
Fourth quarter	448
1912—First quarter	131
Second quarter	276
Third quarter	261
Fourth quarter	297
1913—First quarter	259
Second quarter	254
Third quarter	204
Fourth quarter	78
1914—First quarter	219
Second quarter	269
Third quarter	140
Total	8,680



THEATRE AND CONCRETE STEPS LEADING TO WORCESTER PLAZA, CULION LEPER COLONY.

On September 30, 1914, a total of 3,464 lepers were segregated at Culion and 125 were detained at San Lazaro Hospital, Manila.

A census of 1,209 of the colonists by ages and sex in 1910 showed the following results:

TABLE OF 1,209 LEPERS IN CULION LEPER COLONY.

Age.	Male.	Female.	Total.
1- 5	2	1	3
6-10	35	16	51
11-15	93	43	136
16-20	150	85	235
21-25	113	82	195
26-30	121	65	186
31-35	66	35	101
36-40	77	26	103
41-45	39	19	58
46-50	30	17	47
51-60	30	18	48
61-70	19	11	30
71-80	6	1	7
81-90	1	1	2
91-	0	0	0
Age or condition not known	2	5	7
Total	784	425	1209

The youngest case was 3 years of age. The number gradually increases up to the age of 17, at which age there were 63; at 18 years the number was almost doubled, being 106;

the largest number occurred at the age of 21, when 139 were registered; at the age of 24 there were 102 cases. From this age the number declines comparatively rapidly.

It will be seen, therefore, that the disease occurs more frequently during early manhood and womanhood.

The proportion of males to females at the colony is usually about 2 to 1.

No definite conclusions have been reached with regard to the method of transmission of the bacillus from one person to another. It would seem, however, that in the absence of an actual wound infection, long continued close association with a case is necessary to induce infection. That the disease is not highly infectious is evidenced by the fact that a large percentage of the population of the Islands have not contracted it when so many widely distributed centres of infection have existed for years.

TREATMENT.

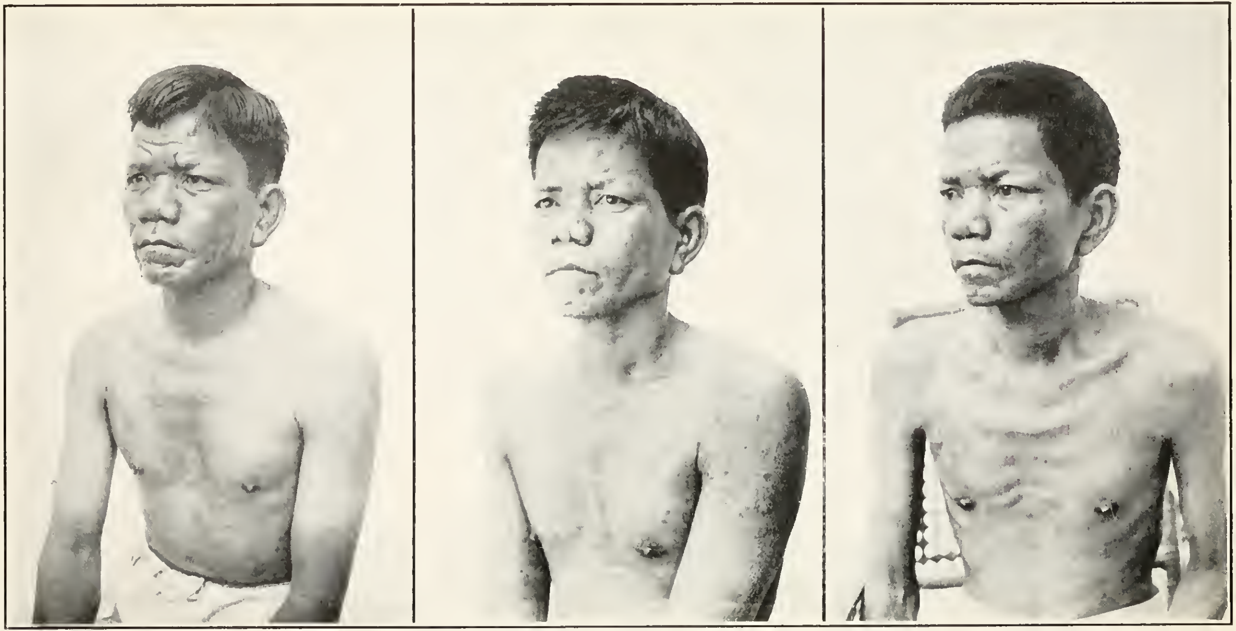
The policy of the Bureau of Health has been to give all bona fide new remedies recommended for the cure of this disease a thorough trial. Very few of them have given encouraging results.

A series of cases for a time appeared to show marked improvement under treatment with the X-Ray, but after the treatment was discontinued they relapsed.

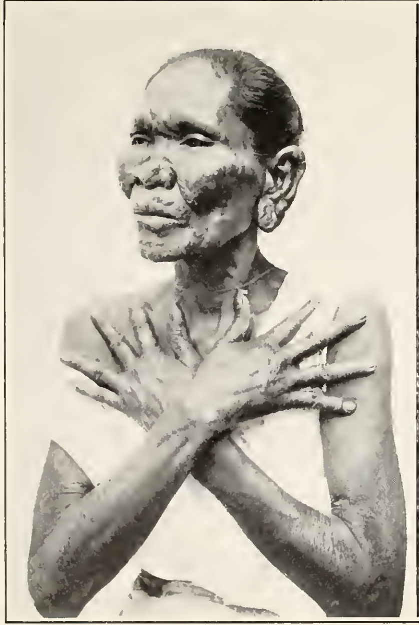
Chaulmoogra oil has given the most promising results. For a time it was exhibited in the form of the crude oil and given by mouth, injection, or inunction, with more or less satisfactory results. During the past few years chaulmoogra oil with camphorated oil and resorcin have given really encouraging results, though these results do not indicate that this combination is in any sense a specific for the treatment of leprosy. The following extract from the annual report of the Bureau of Health for 1913 indicates the method of administering the prescription referred to and the results obtained in two cases:

"On June 11 there were released from San Lazaro Hospital two persons who were formerly afflicted with leprosy and have now been pronounced free from the disease.

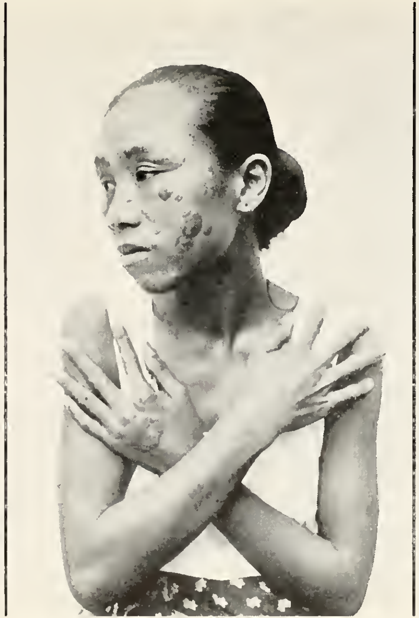
"C. A., male, Filipino, age 27, admitted to the San Lazaro Leper Hospital May 29, 1909. On admission the case presented thickened reddish spots on the nose and thickening and discoloration of the lobe of the right ear. Smears made from the lesions were positive for leprosy bacilli. Beginning August 1909, he received vaccine treatment at intervals for one year, but apparently there was no change in his condition during this period. From September 1910, to November 1910, he took crude chaulmoogra oil by mouth, beginning with daily 15-drop doses and by November reaching 60 drops per day. The oil was given three times daily in divided doses. Beginning in November he received hypodermic injections of the following prescription of Doctor Mercado, house physician at San Lazaro Hospital:



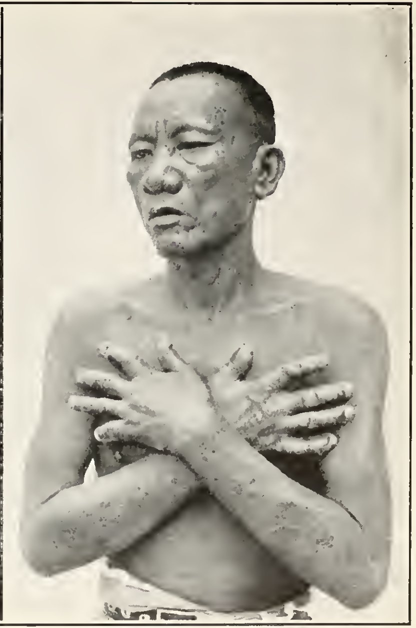
TUBERCULAR LEPROSY.
Showing improvement under treatment with chaulmoogra oil, resorcin, and camphorated oil.
Photographed February 21, 1912, August 19, 1912, and October 28, 1913.



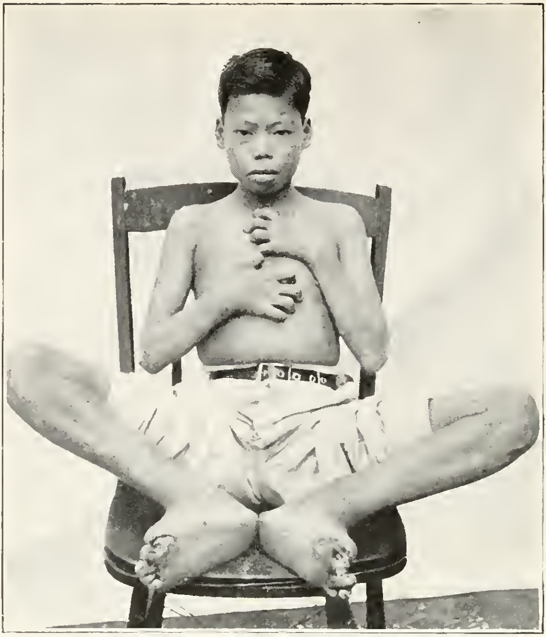
A WELL DEFINED CASE OF TUBERCULAR OR NODULAR LEPROSY



TUBERCULAR LEPROSY, SHOWING EARLY NODULAR LESIONS.



A MIXED CASE OF LEPROSY. Note clubbed end of right thumb and ulcers on fingers. Face presents lesions of the tubercular type.



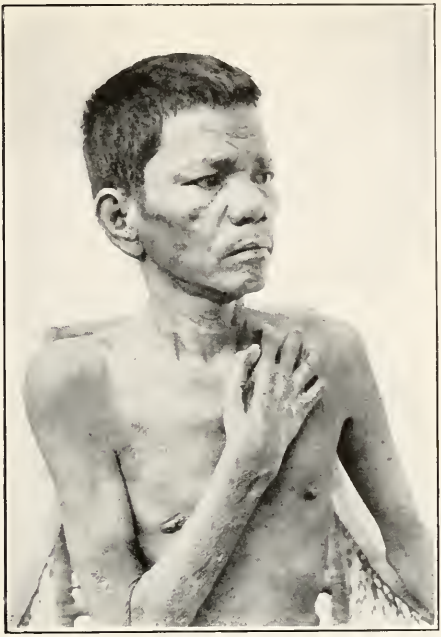
TYPICAL ANAESTHETIC LEPROSY.
Note contraction of fingers, and ulcers on feet.

Chaulmoogra oil	cubic centimeters	60
Camphorated oil	cubic centimeters	60
Resorcin	grams	4

Mix and dissolve with the aid of heat on a water bath, and then filter.

"The foregoing mixture was given as follows: During November, 2 cc. every three days; during December, 5 cc. every eight days; during January, 10 cc. every eight days.

"As this large dose was being borne badly it was reduced to 5 cc., which amount was injected every eight days from February to May. There was apparently no change in his condition at the end of the year following the vaccine treatment. During the treatment with crude chaulmoogra oil by mouth there was some improvement in his condition. This improvement continued during the time that hypodermic injections were given, and on May 6, 1911, all the lesions above described had disappeared and it was impossible to demonstrate the leprosy bacillus. All treatment was then discontinued for a period of one year, during which time he remained negative microscopically. From August 1912, to June 1913,



A CASE OF LEPROSY SHOWING AREAS OF PARCHMENT SKIN ON ARM AND CHEST.

2 cc. were given every ten or thirteen days until the time of discharge.

"The second case was that of C. A., a Filipino woman, age 22, admitted to the San Lazaro Leper Hospital on January 7, 1910. She had a generally suffused countenance and small red macules on the cheeks, forehead and chin. Scrapings from these lesions were positive for leprosy bacilli. Vaccine treatment was begun January 15 and continued for a period of five months. At the end of the first month there was apparently no improvement in her condition, and crude chaulmoogra oil was given by mouth in ascending doses. The initial dose was 30 drops per day and had reached 300 drops at the end of four months. At the close of this period there was some apparent improvement, but the oil was no longer borne well, and the chaulmoogra-oil mixture mentioned in the previous case was administered. For the first month 1 cc. was injected into the buttocks every eight days. The next month 10 cc. was injected every four days. Then one dose of 15 cc. was given. After that 5 cc. was injected every six days. By May 6, 1911, there was great improvement in her general appearance and she was microscopically negative for leprosy. During September 1911, all treatment was discontinued for nine months. Beginning in June 1912, 2 cc. was injected every eight days. Microscopical examinations were made at frequent intervals, but always with negative results. On June 11, 1913, the date of her discharge, all macules had disappeared, but there was still some suffusion of the countenance.

"It is not known whether the vaccine treatment had any influence in these cures. It may be said, however, that there are a number of other cases at San Lazaro Leper Hospital, and at the Culion Leper Colony that have been negative for nearly two years, which presented more marked lesions than those already discharged, and yet they received only chaulmoogra oil, no vaccine being employed.

"Apparent cures have been reported from time to time in the past from San Lazaro Hospital, but unfortunately all of them relapsed or died from some intercurrent disease soon after a period of one year. The cases now reported have been negative for a period of two years and there seems to be ground for hope that the results may be more permanent."

A distinct advance toward the ultimate discovery of a serum for leprosy was made during 1909 by Mr. Moses T. Clegg, at that time employed in the Government laboratories, in the cultivation of the leper bacillus on an artificial media.

There is an urgent need for the services of a commission for the study of leprosy in the Philippines. The field is large and the facilities for research work at Culion are probably unexcelled. It is believed that such a body would, within a comparatively short time, be able to impart definite knowledge as to the method of transmission, which would be of great practical value, and possibly evolve a definite cure for this most distressing malady which makes its victims outcasts from society and condemns them to a life of isolation with scant hope of ultimate recovery.

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SUGAR INDUSTRY OF THE PHILIPPINES

By C. W. Hines, *Station Superintendent, Bureau of Agriculture*

THE sugar cane is a member of the large family of grasses. Its natural home is a tropical country having an average temperature of about 77° F. (25° C.). It requires a moderate degree of humidity, but a dry season during harvest period is imperative if a cane of high purity is to be milled.

Climatic conditions of the Philippine Islands.—The Philippine Islands possess climatic conditions which are particularly favorable to the growth of sugar cane. The dry season starts from one to two months before harvest begins, which permits the cane to reach a very high purity (sometimes as much as 92°) after a growth of a year. There is usually sufficient rainfall during this period to keep the ground moist and to start the "ratoon" and newly planted cane. The rainy season begins about June and continues with intermediate rains and sunshine until October or November. The ground must be provided with proper drainage for this period of wet weather when little or no cultivation may be given the cane, except occasional weeding.

If proper attention is given, the cane will make a luxuriant growth in this season, during the days of sunshine; but the heaviest growth occurs just at the close of the rainy season while the ground is yet moist.

Windstorms during the rainy season often cause the cane to become bent and matted together, especially where the softer native varieties are used, but when improved varieties with firm stalks are planted, this trouble is less apparent. Such varieties also resist insect attacks and damage by small animals better than do the soft native varieties.

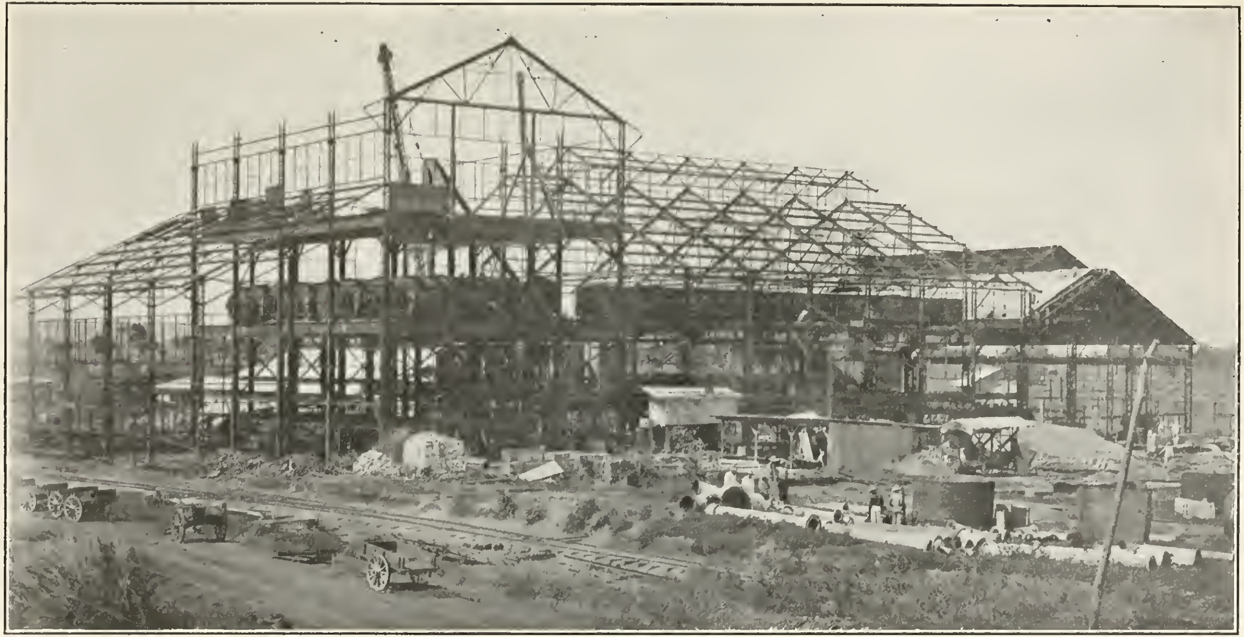
History of the industry.—Sugar cane has been grown in the Philippine Islands for a great many years. It was probably introduced from Formosa by the Chinese, but no definite record has been found to prove this point, except that the implements and methods employed are the same as those used by the Chinese in other countries. In some localities the massive granite rolls imported from China are used to this day. These are set vertically, two or three in a line, and serve to extract the juice from the cane.

The "pilón," or earthen jar, used for packing the sugar is extensively employed for sugar exported to China, or used by the Chinese merchants of Manila.

When Magellan discovered the Islands in 1521, he found a sugar industry existing on a small scale. Different writers from time to time have also mentioned the existence of this industry.

It was probably first carried on in the island of Luzon with crude Chinese methods, and as the export trade in sugar increased, it was extended to other islands. In the year 1795 we have the first authentic record of this product. At this time some 296,219 pounds of Philippine crude sugar were exported from the Islands to the United States. Finally the Island of Negros became the center of sugar production because of its special adaptability to the industry. In the year 1854 the sugar exports from the Philippines exceeded 47,000 tons and constituted 33 per cent of the total exports. From this time until 1890 the industry gradually increased in importance until the average annual export for the four following years amounted to 200,000 tons with a value of $7,534,838.

Muscovado sugars, called "mat sugars," were largely made previous to this time, and these were readily disposed of the world over. Later there was a demand for a better grade of crude sugar which necessitated modern methods of manufacture. Most



Calamba sugar factory at Calamba, P. I., built in 1913, has a daily capacity of 1,200 tons of cane or 150 tons of sugar.

of the sugar-producing countries met this demand by the introduction of machinery and methods for the making of centrifugal sugars. The Philippines, however, have been slower to make these changes, so that to-day many old native factories still exist in the rich cane lands in the different sugar districts of the Islands.

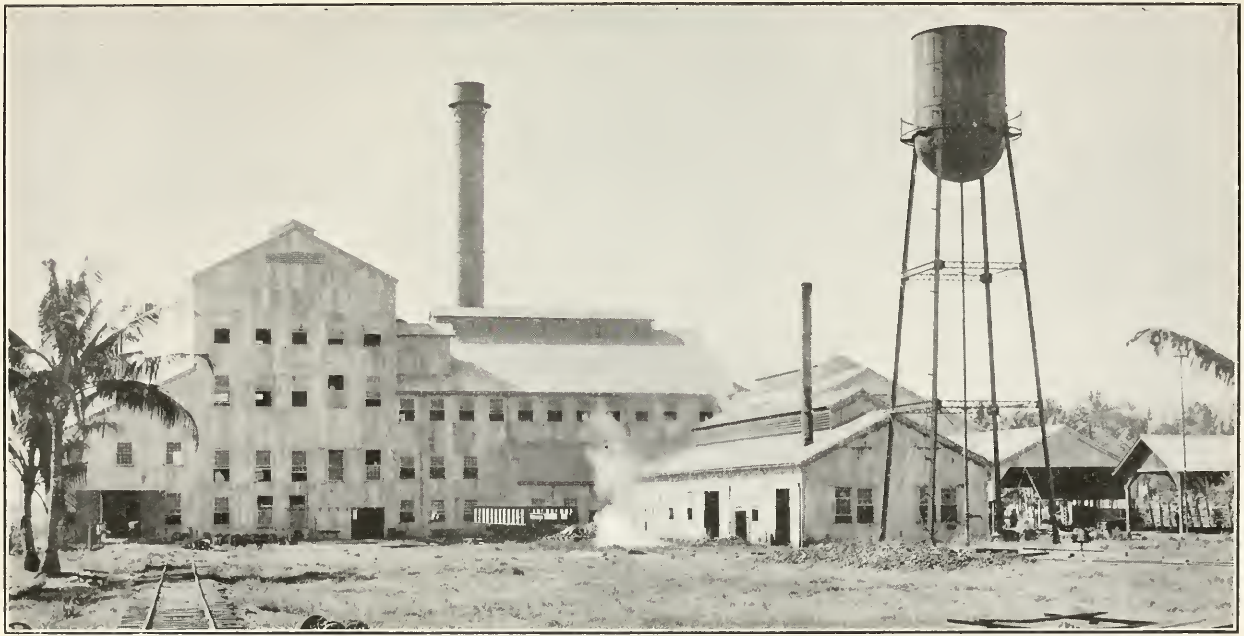
About eight years ago the first factory for the output of centrifugal sugar was built. This was found to be a great success, and the product turned out was in such demand that there are now 15 of these factories with a total daily capacity of 4,500 tons of cane, or 500 tons of sugar. The last addition to this list of factories was a strictly modern plant equipped to handle 1,200 tons of cane per day.

There is also one refinery operating here which turns out some five grades of sugars. These are largely made from crude Philippine sugars. On this account the factory should be considered a "refining plant" in the truest sense of the word, since the fine granulated sugar manufactured compares very favorably with that made by the refineries using centrifugal sugars in the United States and Europe.

Varieties of sugar cane.—There are five or six varieties of native cane growing in different sections of the Islands. These are of various colors including yellow, green, pink, red, and one that is almost black.

In recent years, the Bureau of Agriculture has introduced more than 40 improved varieties from various sugar-producing countries. Many of these canes have proved to be far superior to the native varieties and give a heavier yield of sucrose and tonnage. They are more firm and better prepared to resist windstorms, insect pests, etc. Yet the Filipino planters have been slow to plant these varieties since they are more difficult to mill in small factories.

Soil preparation, planting, harvesting, etc.—The soil is made ready for this crop by plowing and cross plowing until it is well broken up. Then disks and



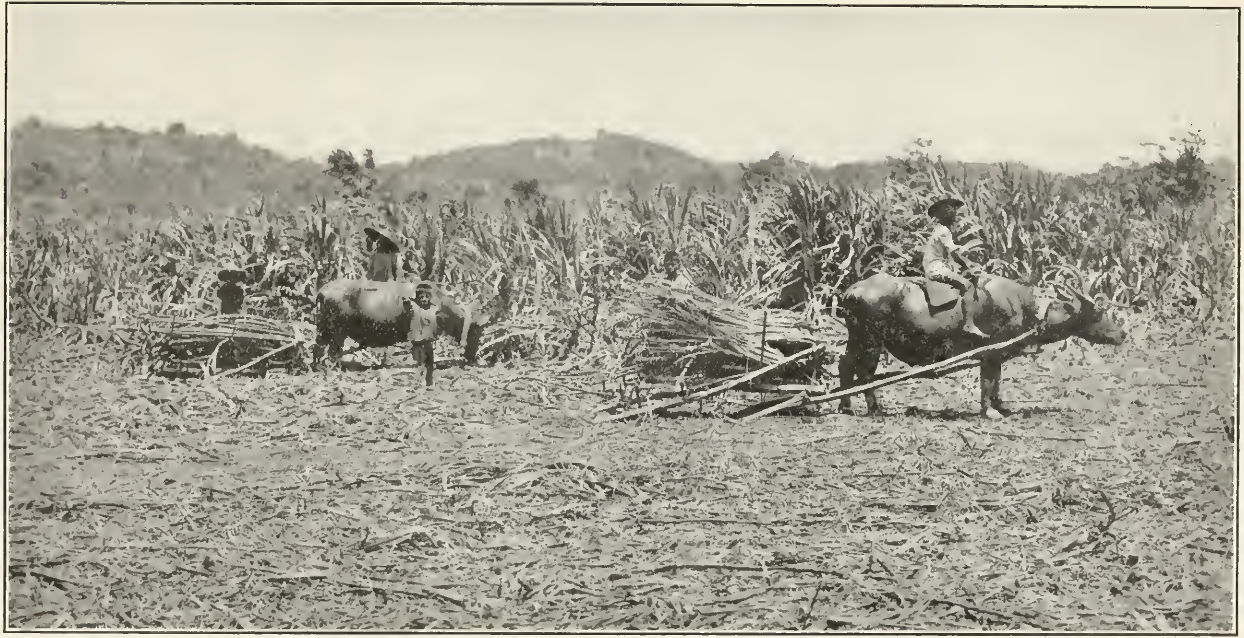
San Carlos sugar factory on the Island of Negros, P. I., with a daily capacity of 800 tons of cane or 100 tons of sugar.

harrows are used until the seed bed is in good condition. The native method, which is practiced to this day on many of the small plantations, is to use a wooden plow and a wooden harrow for this work. These implements are drawn by a carabao (water buffalo). On the larger modern estates, however, steam or gasoline power is used and the modern implements serve to loosen the soil to a much greater depth than is possible with the old methods.

Planting is usually started early in December and continues for some five months. This work is necessarily done at the time of harvest, since the top joints of the cane which are yet immature are used for planting. These pieces are cut in lengths of 6 or 8 inches and after receiving a preliminary soaking of one or two days in running water, they are planted in rows usually 6 feet apart.

"Yellow Caledonia" sugar cane imported from the Hawaiian Islands.

Hand labor is used exclusively in harvesting the crop. The leaves are stripped from the stalk and the top is removed, after which the stalks are cut down and placed in piles for transportation to the factory.



Native method of transporting sugar cane in the Philippines.

Various methods are used for the transportation of the cane and sugar on the plantations, but the modern factories employ narrow-gauge tracks and locomotives. These have given universal satisfaction wherever the amount of cane produced is great enough to warrant such an expenditure.

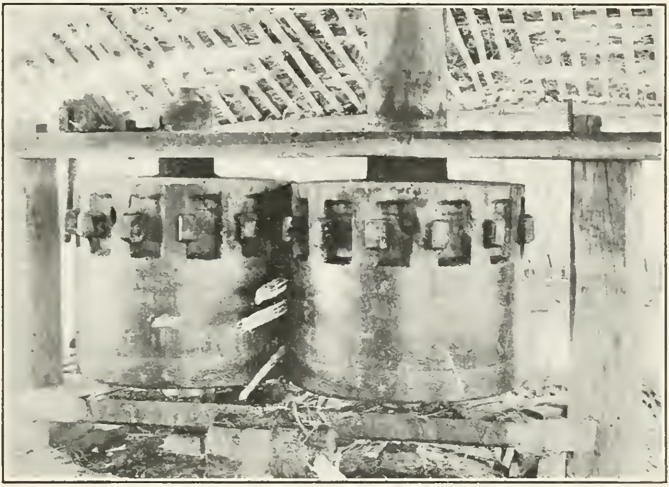
Method used in making crude sugar.—The method of clarification used for the making of Philippine low-grade sugars is very crude and inefficient. The juice from the mill is passed to the first kettle. Here air-slaked lime mixed with a little water or juice is added, and a fire is built underneath. When boiling begins, some of the light impurities come to the top and are removed. The juice is then dipped to the second kettle where evaporation is continued. From the second, it is passed to the third, and from the third to the fourth. Usually four, but occasionally five, kettles are all that are used. In every case the juice is dipped from one to the next as the water boils away, until the last is reached, where final concentration is made.

When the heavy sugar solution has been boiled to the proper consistency so that it will begin to crystallize during the cooling, it is dipped into one of the earthen jars, known as "pilón," or placed in a wide shallow box and stirred until it becomes crystallized. In this case it will be placed in mat bags called "bayones."

Grades of sugars.—Many grades of sugars are found in the markets of the Philippine Islands. First may be mentioned "pilón" sugar. The jars which receive these sugars are bell-shaped and are usually about 18 inches in diameter at the top, by about 24 inches high, and contain from 100 to 140 pounds of sugar. They have a hole 2 inches in diameter at the bottom to let the molasses drain away from the crystals.

Pieces of "bagasse," or cane fiber, are first placed over the hole in the bottom, to prevent the hot "massecuite," or sugar solution, from running through. The pilón is then either set over another smaller jar or over a trough to catch the molasses that drains from the hole. Pilones are left dripping in this manner for six or eight months or until they are to be marketed.

The pilón sugar as it comes from the "hacienda"[1] is of three classes. The first is from the top of the pilón. This contains little molasses and has fairly good crystals. The second, from the middle, is of a lower grade, and the third, from the bottom, is very poor and contains much molasses. When this sugar is used by the local refinery, the low grade is separated from the better and is given a special treatment of clarification.



Old granite rolls used in extracting juice from sugar cane.

A great deal of this pilón sugar is used by the Chinese in Manila for making a semirefined lump sugar called "caramelo." The crude process of refining begins before the sugar is removed from the earthen jars. A layer of clay is first applied over the top and is kept soaked with water, which tends to wash away the molasses adhering to the crystals, and also to bleach the sugar. The better portions of the sugar are then separated and dissolved. The sirup is clarified with lime and albumin of eggs and finally recrystallized during constant stirring. This sugar is cut into slices of about ½ by 2 by 3 inches while still hot, and is used as a coffee sugar by the Filipinos.

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[1] Plantation.

The bulk of Philippine sugar exported at present is of the "mat" sugar type. It is so called from the fact that the containers are sacks made of a kind of mat from the leaves of the buri palm.

This sugar is made in identically the same way as pilón sugar up to the time that it is dipped from the kettles, when it is placed in large shallow boxes and immediately stirred until crystallized. It is then cooled and placed in the "mat" bags, reinforced by a piece of rattan. Each of these bags holds about 40 pounds of sugar.

There is a great difference in the grade of even these crude sugars. This is caused by the difference in the condition of the juice from which they are made as well as by the method of clarification and boiling. They are usually classed in different grades as follows:

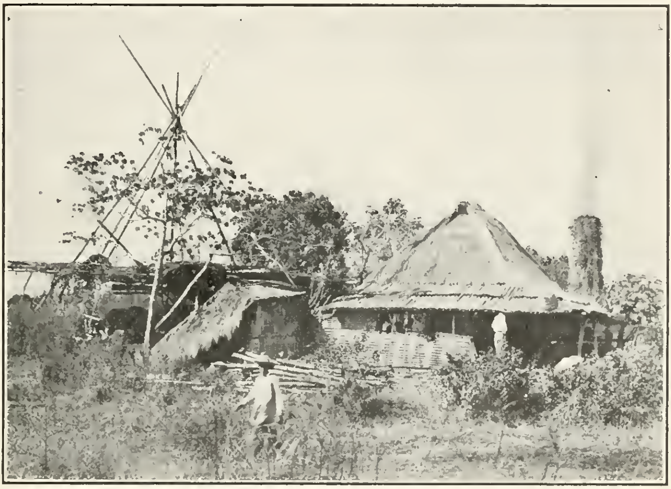
No. 1, which polarizes from 87° or above.
No. 2, which polarizes from 85° to 86.9°.
No. 3, which polarizes from 82° to 84.9°.
No. 4, which polarizes from 80° to 81.9°.
No. 5, which polarizes from 76° to 79.9°.

Sometimes No. 6 or "corriente" is made which is a very low grade of black molasses sugar.

About one-fifth of the local consumption of sugar is in the form of sugar cakes called "panochas." These cakes are made of crude sugar molded in half-shells of coconuts. They vary from 1 to 2 pounds in weight and are consumed very generally throughout the Islands.

The centrifugal factories usually make 96° test sugar to be used in a refinery where it is afterwards melted and made into granulated sugar. However, several factories have recently produced very good yellow clarified crystals for local consumption by the sulphurous-acid and the phosphorous-acid methods.

Experiments with the cane juices here have demonstrated that high-grade plantation sugars may readily be made with a minimum of expense on account of the high purities of the juices. There is no doubt but that the modern factories will soon adopt a system to supply not only the best grade of sugars consumed here, but also a large portion of the crop for export.



Native sugar factory of the Philippine Islands.

Labor.—The labor situation in the Philippines is much the same as that found in other tropical countries. Since practically all the industries here are carried on by the use of hand labor, there is usually a scarcity of labor at harvest time which is also the time of planting the new crop. The larger factories now being built employ every labor-saving device possible. While this arrangement minimizes the personnel required for the factory, yet the cutting and planting is all done by hand. The latter is accomplished by women and children who receive from 20 to 25 cents per day.

Transportation.—Transportation throughout the Philippine Islands has been very much improved since American occupation by the building of railroads and macadamized roads, yet the transportation to many of the rich cane lands is still quite poor.

In some sections there are rivers over which the sugar may be floated in small boats to the sea where it is loaded upon the larger ships. There are few places where sugar may be loaded directly upon large ocean liners. One great difficulty experienced in many sections is the necessity of first loading the sugar on lighters for shipment to the large steamers, since there is usually very shallow water for some distance from the shore.

Land available for sugar cane.—There were about 435,200 acres of land under cultivation in sugar cane in 1913. This represents but about one-half of the land suitable for this crop.

When modern apparatus and methods are universally employed here, much of the uncultivated land will probably be utilized for this crop as well as a portion of the land now used for other purposes.

Sugar legislation.—In 1902 Congress passed a law admitting Philippine products into the United States under a duty reduction of 25 per cent. It was presumed that such legislation would bring about great improvement in the sugar industry. However, this did not succeed in attracting outside capital for the development of the industry.

In the year 1909, the Payne-Aldrich bill was enacted which offered material relief to the situation.

This provided free entry into the United States each year for an amount of sugar not to exceed 300,000 tons. The duty on sugars imported into the

United States from foreign countries at that time was \$1.66½ per 100 pounds of 96° test sugar, consequently the effect of the law was to greatly stimulate the sugar industry of the Islands. Prior to the passage of this law most of the export sugar went to China. In the year 1910, 94,000 tons of sugar went to the United States, while in 1911 seven-eighths of the total amount exported was sent there.

The latest tariff legislation, known as the "Underwood Bill," provides for the gradual reduction of the tariff on sugars imported from foreign countries until the year 1916 at which time sugar is to be placed on the free list. Philippine sugars are now admitted free of duty to the United States, irrespective of amount.

Export of sugar.—By far the greater portion of the sugar exported from the Philippines belongs to the higher grades of "mat" sugars which are on a par with the centrifugal "seconds" of the United States. Nearly all of the centrifugal sugar produced in the Islands is also exported, there being little local demand for it at present. The growth of the sugar exports may be seen in the following table:

Exports of sugar

Fiscal years.	Quantity.	Value.	Average value per ton.	Percentage of total exports.
	Long tons.	*Dollars.*	*Dollars.*	
1905	111,845	4,977,026	44.50	13.4
1906	123,807	4,863,865	39.29	14.8
1907	118,389	3,934,460	33.23	11.5
1908	149,316	5,664,666	37.94	17.2
1909	110,605	4,373,338	39.54	14.0
1910	125,700	7,040,690	56.01	17.6
1911	147,017	8,014,360	54.51	20.1
1912	183,078	10,400,575	56.81	20.6
1913	209,183	9,491,540	45.37	17.8

It will be noted that the export for 1913 was the largest ever reported, but on account of the low prices that year it brought less income to the Islands than the smaller export of 1912.

The countries to which sugar was exported and the amount of such exports during the fiscal years 1912 and 1913 were as follows:

Exports of sugar—by countries

Countries.	Fiscal year 1912.		Fiscal year 1913.	
	Quantity.	Value.	Quantity.	Value.
	Long tons.	*Dollars.*	*Long tons.*	*Dollars.*
United States	159,227	9,142,833	82,625	3,989,665
United Kingdom	8,336	561,300		
China	3,995	164,805	35,310	1,577,424
Hongkong	7,655	351,603	49,924	2,137,415
Japan	3,860	179,745	41,313	1,786,396
British East India	2	139	10	640
Guam	2	150		
Total	183,077	10,400,575	209,182	9,491,540

Production.—The total production of sugar in the Islands is about 100,000 tons in excess of the export. In other words, that amount is consumed locally in various forms. During the fiscal year 1913 the reported production was 308,107 long tons. The sugar locally consumed consists of about 80,000 tons of "pilon" and "mat" sugars, and 20,000 tons of "panochas."

Future prospects.—Present indications point to rapid improvement in cultural methods, milling, and refining processes in the sugar industry throughout the Islands. Since the sugar lands are so located as to warrant the construction of modern mills at many different central points, it is anticipated that in the near future additional mills of such type will be constructed. The pioneer factories already in existence have invariably been successful when suitably located with respect to districts of heavy production.

The maximum yields of sugar in the Philippine Islands have never been obtained on a large scale, but with the favorable climatic conditions, rich soils, and possibilities for irrigation in many sections, there is no reason why equal if not even greater yields might be expected than those of the fertile lands of Hawaii, when modern methods are employed.

Further information on this subject may be obtained from the director-general of the Philippine Exposition Board, Panama-Pacific Exposition, or by application to the Director of Agriculture, Manila, P. I.

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SUGAR AND ALCOHOL FROM PALM SAP

SUGAR

FROM time to time palm saps have been suggested as a source of sugar. The nipa palm has very great advantages over any other palm in this respect, as it is found growing wild in pure stands on otherwise worthless lands. Furthermore, unlike most palms, the fruit stalk from which the sap is drawn grows at a height of only 2 or 3 feet above the ground, thus making the collection of the sap easy and cheap.

The nipa palm covers large areas of tidal swamp land in various parts of the Philippines. It requires low river land subject to periodic overflow by brackish tide water. Other than this, it has few requirements for healthy growth. At present the sap of these palms is utilized on a large scale commercially for the production of alcohol. About two and one-half million gallons of proof spirits were obtained from this source in 1913, 75 modern distilleries being engaged in the industry. There are, however, large areas of excellent swamp at present untouched, and even larger areas of land suitable to the growth of this plant which are worthless for any other purpose.

The sap is collected by cutting off the new-formed fruit and hanging a vessel under the severed end of the fruit stalk. The flow continues for two or three months, diminishing in quantity toward the last, but averaging about 10 gallons of sap per stalk during the season. The palms grow thickly, about 800 to the acre, of which a third or more produce each year. Fair nipa swamp will, therefore, produce up to 3,000 gallons of sap per acre. The producing season extends over about six or seven months of the year, beginning in July.

In regard to quality, the sap compares very favorably with cane or beet juice. It contains about 15 per cent of sucrose, and has an average apparent purity of 85. The impurities consist mostly of inorganic salts, chiefly sodium chloride. Invert sugar and other melassigenic substances are practically absent, and the production of excellent centrifugal sugar, presents no obstacles. The same methods and plant in use for handling cane juice are adapted to nipa sap, with only slight modifications.

Cultivated nipa swamp, Bulacan.

At first glance the most serious problem seems to be the collection, preservation, and transportation of the sap to the factory. It has been demonstrated, however, that the sap can be grown and delivered to a reasonably well-located factory at a cost well within the amount allowable for profitable working. The juice can best be collected in the bamboo vessels to which the Filipinos are accustomed. The use of a little lime cream and sulphite prevents inversion and deterioration and prepares the juice for processing in the factory. The cost of such sap at the mill, including growing, should not exceed from $5.50 to $6 per 1,000 gallons. At the present time millions of gallons of the sap are annually being delivered to distilleries at a lower figure than this.

One thousand gallons of sap, with fairly efficient processing, will produce nearly 1,000 pounds of centrifugal sugar polarizing at 96°. With sugar at present prices the margin of profit above manufacturing costs appears very attractive. This is especially true since no grinding expense is involved, as with sugar cane. The manufacturing costs should certainly fall below those of cane sugar.

It is estimated that from 1,100 to 1,200 acres of swamp would supply a factory with a capacity of 10 tons of sugar daily. There are innumerable compact areas of good swamp of this size or larger to be found in the Islands. Capital with a little pioneering courage would be handsomely rewarded for an experiment in this direction, unless the results of careful investigation are entirely misleading.

REFERENCE

Nipa palm as a commercial source of sugar. *The Philippine Journal of Science, Section A* (1913), **8**, 377–398. No. 6.

THE ALCOHOL INDUSTRY

The alcohol industry is highly organized, and among the manufactured products of the Islands distilled spirits and liquors rank second only to tobacco. The reason for this lies in the availability of palm saps in large quantities, a raw material almost unique and particularly well adapted to the purpose. Palm saps, chiefly those of nipa and

Collecting the nipa sap.

coconut, furnish practically all the alcohol produced in the Philippines. The sap is collected by cutting the recently formed fruit at its point of attachment to the fruit stalk. The sap flows freely from the freshly cut surface of the stalk, and is collected in bamboo vessels. A stalk normally flows for about three months, during which time it produces from 8 to 13 gallons of sap, the greater portion of which is secreted during the first two months after tapping. The sap, or tuba, is emptied either into large earthen jars, or directly into the bancas (canoes) for transportation to the distillery.

An analyses of the saps of the Philippine palms show a variation in different individuals of the same species due to local conditions and also in the same palm at different periods of the sap flow. Nevertheless, there is a remarkable uniformity in the composition of the saps of the different species. They contain from 12 to 15 per cent of cane sugar. As they exude from the trees they are practically neutral and contain no sugar other than sucrose. The process of inversion of the sucrose and fermentation commences almost immediately upon exposure to the air.

A few years ago there were in operation in the provinces about 600 primitive distilleries, which have now entirely disappeared except for illicit purposes. The distilling apparatus consisted of a fireplace, a pot and condenser in one, and a delivery tube for carrying off the distillate. The pot and condenser was composed of a wooden cylinder between two iron pans. The bottom pan rested on the fireplace, and the top pan was kept filled with cold water during the distilling operation and thus acted as a condenser. The vapors condensing on the convex undersurface of the pan dropped into the delivery pipe of bamboo, and were carried to the receiving vessel on the outside. The larger pots were connected with a lever, by means of which they were swung clear of the lower pan for purposes of cleaning and filling.

The distillates produced with this crude apparatus averaged about 25 per cent alcohol and seldom ran over 30 per cent. They were much prized by the natives of some localities, and were preferred to gin, anisado, and other beverages of higher proof manufactured in more modern apparatus.

Nipa palms in fruit.

The present-day distilleries are of the most modern type. On June 30, 1913, there were in operation throughout the Islands 75 registered stills of modern type. Practically all distilleries of the Philippine Islands are equipped only for the handling of palm sap. A much larger equipment is required to produce alcohol from molasses, as it takes from six to ten days for the fermenting process as compared with one day for palm sap. The distilled spirit produced ranges as high as 93 per cent absolute alcohol.

During the fiscal year 1913 the collected sap of the nipa palm produced about two and one-half million proof gallons of distilled spirits. From the sap of the coconut palm 130,000 gallons of proof spirits were produced. Among other classes of distilleries waste sugar and grain produced 160,000 gallons of proof spirits. The total tax paid upon these 2,800,000 proof gallons amounted to some $1,300,000, or a little over 11 per cent of the total collected revenue of the Islands. In addition, nearly 200,000 gallons of proof spirits were used for industrial purposes without payment of tax.

The industry suffers much from want of careful control of the manufacturing processes. Under good technical methods of operation exceptionally large profits may be expected upon the capital invested. There are very large areas of nipa swamps in the Islands which are entirely unused at present. These offer excellent opportunities for investment.

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RICE

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RICE IN THE PHILIPPINES

By H. O. Jacobson, *Chief, Division of Agronomy, Bureau of Agriculture*

RICE, the staple food crop of the Philippine Islands, is grown in every province. The prevailing system is single cropping with little or no attempt to restore the fertility of the soil.

In most sections but one crop is produced annually, taking advantage of the heavy periodic rainfall. In a few restricted areas, favored with a more evenly distributed rainfall, and by the aid of irrigation, two crops per annum are grown.

Primitive cultural methods predominate, yet interest in modern methods is showing a healthy growth.

The crop is produced almost wholly by operators handling small areas.

Soils.—Rice is grown successfully on almost all of the soil types in these Islands. The important requisite is a heavy clay subsoil which prevents the loss of soil water by seepage and percolation.

The better rice soils contain not less than 40 per cent of clay (less than 0.00007874 inch in diameter) and 20 per cent fine silt (0.0003937 to 0.00007874 inch in diameter).

Naturally, the rice fields are most common in the level areas.

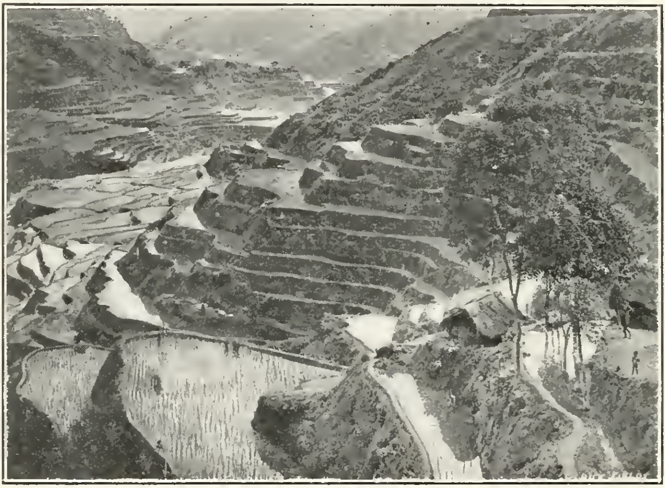
Climate.—The rice crop is produced under two distinct types of climate according to geographical distribution.

One area has a distinct wet and dry season; the other area a fairly well distributed rainfall. However, the bulk of the crop is produced in the region having the former type of climate.

The average rainfall in this region for the five months, June to October, inclusive, amounts to 61 inches.

Cropping methods.—These do not differ much from those obtaining throughout the Orient.

The most primitive method is known as *caiñgin* (ka-ing-een). During the dry season the underbrush is cut down and, when dry, burned. Then the larger trees are cut down and likewise burned. When the rains begin the rice is planted, by making a hole in the soil with a pointed stick, dropping several grains therein, and covering with soil. A second crop is not planted until several seasons have elapsed, when the process is repeated.



Rice paddies in the Mountain Province.

Another method is known as "secano," or upland. The soil is plowed and harrowed during the dry season, and the seed sown broadcast or in shallow furrows at the advent of the rainy season. Weeds are removed by hand. This system is practiced on hilly lands and no water-retaining dikes are provided.

A third method, "sabog" or "pangas," is practiced in areas where water-retaining dikes have been provided. The soil is puddled, i. e., plowed and harrowed until the soil is of the consistency of gruel. The seed is scattered broadcast, and water is provided, if available, in sufficient amounts to maintain a submerged condition of the field after the plants have acquired sufficient growth. If rains fail the crop suffers.

The method known as "tanim" or "tubigan" (lowland transplanting) is employed in producing approximately 80 per cent of the annual crop.

Harrowing.

A seed bed or nursery is provided in which the seed is sown very thickly, requiring from 17 to 35 bushels per acre.

The fields are plowed and harrowed while saturated with water and puddled. When the seedlings are about 6 weeks old, or older, they are transplanted by hand into the fields in hills spaced from 4 to 10 inches apart. Several plants are set in each hill. Women and children do much of this work. The "gang" organization is popular and often music is provided as a means for speeding the movements of the transplanters. Weeds are removed by hand and in some places irrigation supplements the natural rainfall.

A given number of persons can set out a larger area than it can harvest.

There are also minor variations in the practice of all the methods indicated.

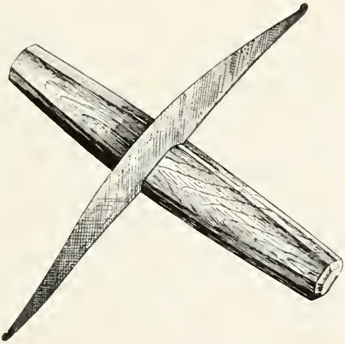
One of the most interesting features of the rice-growing industry as found in the Philippine Islands is the system of terracing practiced in the Mountain Province by the non-Christian tribes.

Transplanting rice.

As shown in an accompanying illustration, the entire mountain side has been converted into a series of rice paddies. It is believed that the examples of engineering as exemplified there are superior in workmanship to any similar feature elsewhere, both in extent and quality. When the very primitive means by which this work has been accomplished are considered, modern feats of agricultural engineering by the aid of the most modern instruments and machinery appear to be less marvelous.

Harvesting.—There is less diversity in harvesting methods than in cultural methods.

Large areas are harvested by cutting the ripened heads one by one, or at the most three at a time, with an implement called "pañgani" or "yatab". This implement is preferred by women, children, and aged men.



"Pañgani" or "yatab," used for cutting single heads of rice.

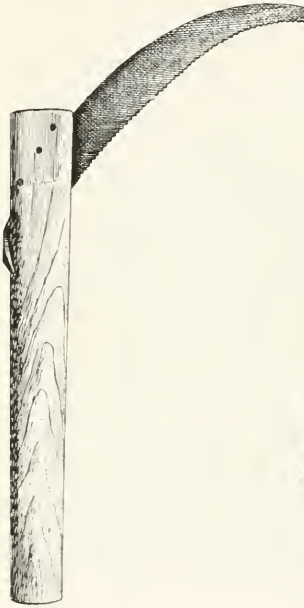
A small sickle ("karit") is used when the crop is to be bound into small "hands" or sheaves, and an instrument called "singcaw" is used for the same purpose. This tool is used by men mostly and with it an industrious laborer working in a normal crop can cut and bind 360 sheaves per day, or about 10 bushels of rough rice.

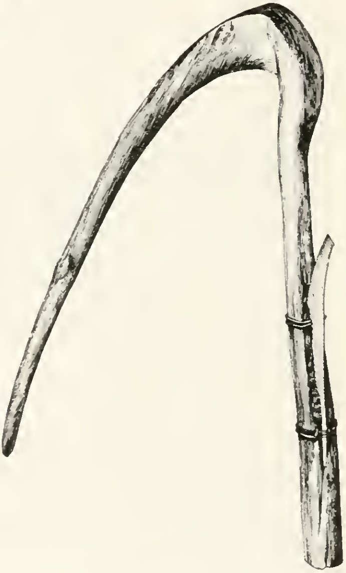
Harvesting is done largely on a crop-share basis, the laborers receiving from one-tenth to one-fourth of the crop for their service, the percentage varying with the labor supply.

Threshing.—To supply immediate home demands part of each crop is immediately threshed, sun dried, and hulled. The main crop is stacked in a very excellent manner, as a rule.

Threshing is still done in most places by various simple means such as treading on a hard earthen floor by human beings or carabaos, treading on slatted platforms, and by beating with flails or against stones or hard wooden boards.

Modern American threshing machinery has become quite popular, there being not less than 130 outfits in the Islands. Threshing is also done on a crop-share basis.


"Karit," or native sickle.


"Singcaw," or hook and sickle combined.

Hulling.—Large quantities of rough rice are hulled with homemade mortars and pestles, or heavy wooden mallets called "mazos." There are also homemade power-driven machines and a considerable number of modern mills. Modern machinery is gradually superseding the old-fashioned sort.

Also, most of the locally produced rice is not highly polished and in the southern half of the Archipelago practically none is polished.

Varieties.—In common with other Oriental rice-producing countries, the Philippine Islands have a great wealth of varieties. The Bureau of Agriculture has studied more than 1,000 varieties. These have been classified into groups as to suitability for growth under upland or lowland conditions, as to bearded or nonbearded, and as to color and composition of kernel.

Rice harvesting.

Varieties vary in color of kernel from the semi-transparent white to the deep, purplish black. This color variation also applies to the hulls.

Certain varieties have been found particularly adapted to special uses and for peculiar conditions. In fact, the great diversity of varieties is not easily comprehended. At the present time the division of agronomy has on file 3,500 variety names.

Production.—The local production of rice for a five-year period is given below:

Fiscal year—	Area cultivated.	Yield of rough rice.	Yield per acre.	Total value on the farms.
	Acres.	*Bushels.*	*Bushels.*	*Dollars.*
1909	2, 856, 735	37, 019, 249	13. 0	26, 177, 994
1910	2, 945, 780	40, 137, 321	13. 6	27, 882, 925
1911	2, 579, 124	43, 693, 690	16. 9	30, 897, 795
1912	2, 665, 939	24, 735, 808	9. 3	19, 990, 644
1913	2, 820, 009	52, 140, 307	18. 5	28, 969, 900

Prior to the eighties there was a surplus production of rice so that it entered into the list of exports, but since that time importations have been necessary to meet the home demand.

The development of the sugar and hemp industries has encroached upon the labor supply available for rice production, as has also the demand for labor for railway building and public works. Besides, there has been a considerable movement of the rural population to the larger centers.

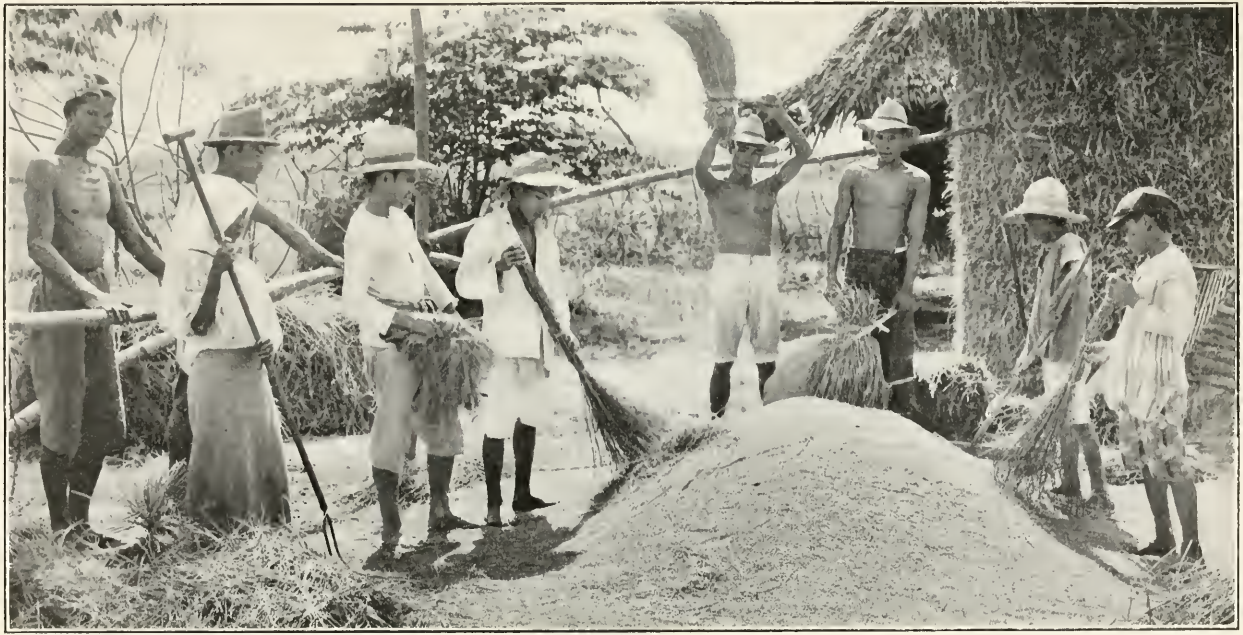
Another highly important factor is the lack of work animals, dating back to the great losses from disease in the nineties.

Cost of production.—Little data is available on this subject as yet, but an estimate published in 1912 by the Bureau of Agriculture for lowland transplanted rice is conservative:

Estimated cost of growing one acre of rice

Preparing of seed beed (nursery)	$0.46
One bushel seed	.59
Plowing 1 acre, 1 man and carabao 4 days, at $0.625 per day	2.50
Harrowing and fitting, 1 man and carabao 3¼ days, at $0.625 per day	2.03
Transplanting, 8 women and children, at $0.20 per day	1.60
Cost of harvesting and threshing	4.29
Total	11.47

In spite of the fact that the margin of profit in rice growing is small, it will probably continue to be one of the most important crops.



Threshing rice by beating.

The crop is most suitable for certain large areas of land, has no substitute for the rainy season in those places, and utilizes much labor which would otherwise secure no compensation or utilization.

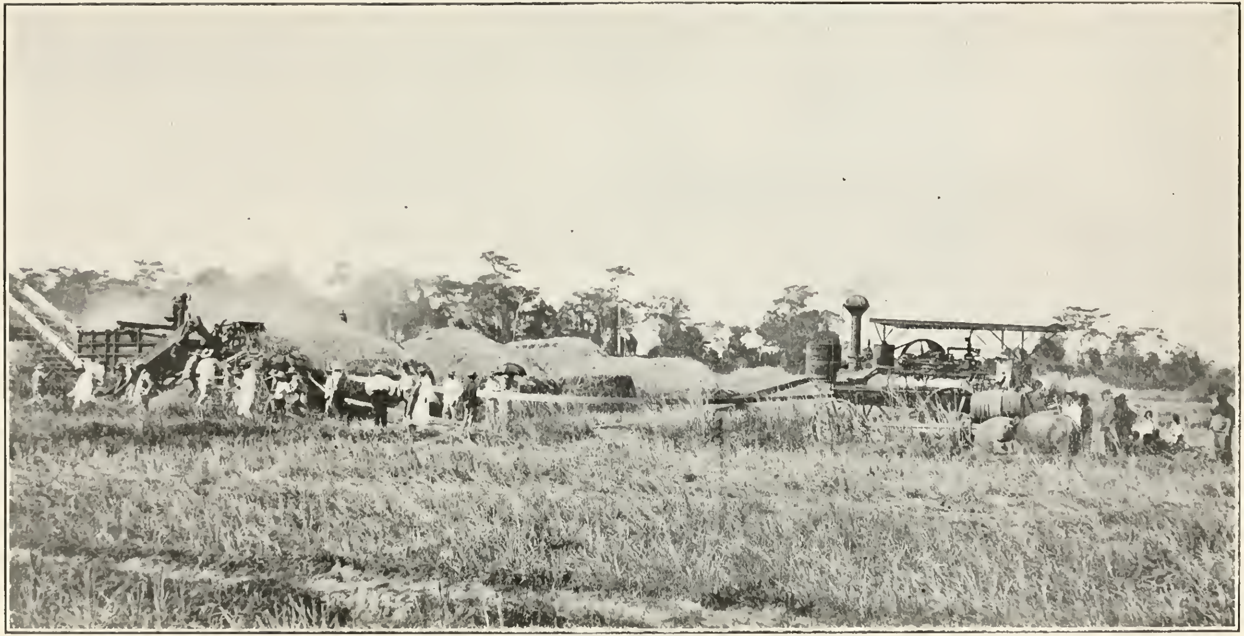
Furthermore, there is not any single food crop which can replace it for the Tropics.

Transportation.—The locally produced crop is very largely consumed by those who produce it. The surplus does not move very far from its place of production. Consequently there is a growing tendency to locate the rice mills at or near centers that produce a surplus.

Threshing; slatted platform.

The five provinces, Pangasinan, Nueva Ecija, Bulacan, Pampanga, and Tarlac lie north-northwest from Manila, two of these provinces abutting on Manila Bay. These provinces contain about one-third the rice-growing area and produce nearly one-half the annual crop. Thus the center of production is very close to the center of population.

A railroad runs from Manila through this rice region, both ends terminating at seaports.



Modern rice thresher.

Imports.—To supply the additional demand for rice, importations have constantly been made during the past thirty-odd years. The volume of annual importations varies greatly according to the condition of the Philippine crop.

During the period 1909 to 1913, inclusive, these importations were as follows:

Importation of cleaned rice, 1909–1913

Fiscal year—	Tons.	Value.
1909	151,764	$4,250,223
1910	203,508	5,321,962
1911	223,860	6,560,630
1912	286,876	10,569,949
1913	197,539	7,940,857

All imported rice pays an entry duty of 1 cent per kilo (2.20462 pounds).

Consumption.—The following table indicates the annual total consumption of cleaned rice:

Fiscal year—	Produced.		Imported.		Total consumption.
	Value.	Quantity.	Value.	Quantity.	
		Tons.		*Tons.*	*Tons.*
1909	$27,955,661	536,861	$4,250,223	151,764	688,625
1910	30,310,323	582,080	5,321,962	203,508	785,588
1911	32,995,971	633,655	6,560,630	223,860	857,515
1912	21,152,791	358,724	10,569,949	286,876	645,600
1913	30,868,561	756,149	7,940,857	197,539	953,688

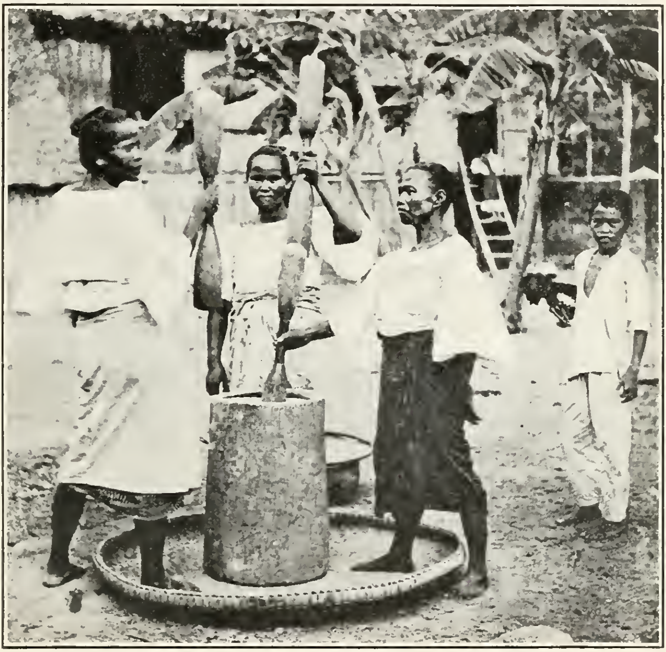
It is estimated that this year (1915) 1,000,000 tons of rice will be required for local consumption in the Philippines.

Uses.—Of course, the main use is for food. The Filipino can cook rice very skillfully and perfectly. Americans in the Philippines have been agreeably surprised to learn that rice cooked and served without any other material is a very satisfactory article of diet.

The favorite method is to place the rice and cold water in an unglazed pot and cook the rice until the water is absorbed and evaporated. The rice then comes out unbroken and somewhat firm. Rice which becomes pasty soon after being cooked is not considered to be desirable.

Rice is also utilized for making alcohol and beverages.

In the Mountain Province red rice is used for making a fermented drink (wine) known as "tapuy." The coloring matter in the cuticle being dissolved in the alcohol produced by fermentation imparts a reddish color to this drink.



Hulling rice.

Glutinous rice is employed in preparing certain fancy dishes and pastries.

Popped rice has evidently been known here for some time. This is prepared from the rough rice, which is placed in a heated iron pan or a vessel containing heated sand; the grains pop open and then the hulls, sand, etc., are removed by sifting. Molasses is mixed with the popped rice and cakes are then molded into sizes and shapes suitable for the retail trade.

By-products.—In the milling process two principal by-products are produced, "tiki-tiki" (rice bran), and "binlid" (broken rice). Tiki-tiki is utilized mainly as stock food, while binlid is used for human consumption, stock food, and for distilling purposes. The rice straw is utilized but little in industries, the greater part of it being left in the field at harvest time, and subsequently burned or plowed under.

Rice booth, Second Philippine Exposition.

Prospects.—The Bureau of Agriculture, as a result of its investigations, is carrying out an aggressive campaign in educating the rice growers in the proper selection of seed. Proper seed selection, when practiced, will have a powerful influence on the volume of the annual crop. The gradual increase in the number of work animals tends to result in increasing the area planted with rice. The extension of irrigation, if continued, is a form of crop insurance especially valuable in rice farming and while there are about 125,000 acres under irrigation at present, there are at least 1,250,000 acres that may be brought under modern irrigation.

As yet there are no serious pests affecting the rice crop which are not controllable.

Further information on this subject may be obtained from the director-general of the Philippine Exposition Board, Panama-Pacific Exposition, or by application to the Director of Agriculture, Manila, P. I.

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THE PHILIPPINE ISLANDS

ABACÁ (MANILA HEMP)

PANAMA PACIFIC INTERNATIONAL EXPOSITION SN. FRANCISCO CALIFORNIA

ABACÁ (MANILA HEMP) IN THE PHILIPPINES

(*Musa textilis.*)

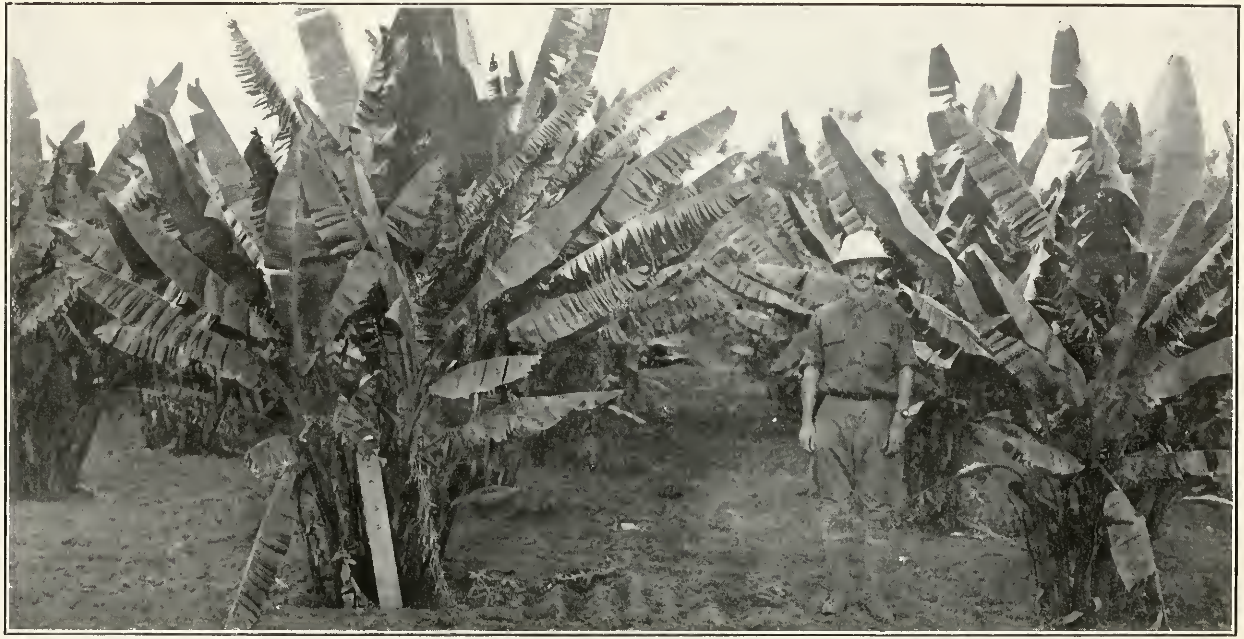
By M. M. SALEEBY, *Chief, Fiber Division, Bureau of Agriculture*

Introduction.—Abacá is not only the most important fiber, but also the most important export product, of the Philippines. For a number of years this fiber comprised approximately two-thirds of the total export trade of the Islands. The recent increase in the production of copra and sugar has reduced in a measure its relative importance, but it still remains our leading export product.

Abacá is the premier cordage fiber of the world. It is a structural (hard) fiber obtained from the outer layers of the overlapping leaf sheaths which form the stalks of the abacá plant. It is very light, strong, and durable. When properly extracted and dried, it is also of a white, lustrous color. One particular feature of the abacá fiber which emphasizes its superiority over all other fibers of its class is its great strength and its resistance to the action of water, hence its particular adaptability for marine ropes.

In the commercial world this fiber is known as "manila hemp" or "manila." It is often called "hemp," especially locally by the English-speaking community, but this term is both incorrect and misleading, and its use should be discontinued in favor of the Spanish–Filipino term "abacá."

History of the industry.—The first authentic account of the use of either abacá or banana fiber in the Philippines is that given by an Englishman, Dampier, who lived in Mindanao in 1686. This writer describes the "banana textoria," both as an edible



Sixteen-months-old abacá (manila hemp) plants, grown by modern methods, La Carlota experiment station, Occidental Negros.

and as a fiber-producing plant.[1] One of the companions of Magellan, Antonio Pigafetta, prepared a description of the plants of the Philippines, but in this paper no mention is made of abacá. The fiber was first exported from the Islands about the beginning of the last century, but the export did not become important until about 1850. In 1820 a sample of abacá was brought to Salem, Mass., by John White, a lieutenant in the United States Navy. From 1824 to 1827 the fiber began to be used quite extensively in Salem and Boston.[2]

Stripping abacá (manila hemp) first process, Albay.

The production of abacá for export did not commence until 1818, when 41 tons were exported. Until 1830 the exports ranged from 100 to 500 tons; but in 1840 they increased to 8,502, or an increase of 8,000 tons in about ten years. During the ten years from 1840 to 1850, the exports remained practically stationary, amounting to 8,561 tons in the latter year. The decade from 1850 to 1860 shows an increase from 8,561 tons to 30,388; while that from 1860 to 1870 shows an increase of from 30,388 to 31,426, or about 1,100 tons only. From 1870 until 1900, the exports increased from 31,426 to 89,438 tons, with an average increase of about 20,000 tons during each decade.

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[1] Probably confusing abacá with banana. The two plants belong to the same genus, *Musa*, of which many species are known to science.

[2] From Bureau of Agriculture Bulletin No. 12, page 10, Manila, P. I.

The quantity and value of the exports of abacá from the Philippines since the fiscal year ending June 30, 1900, are as follows:

[Values in U. S. currency.]

Fiscal year ending June 30—	All countries.		Percentage of total exports.	Average local value per ton.
	Quantity.	Value.		
	Met. tons[a]			
1900	76,709	$11,393,883	52.6	$148.53
1901	112,215	14,453,110	54.6	128.80
1902	109,969	15,841,316	58.3	144.05
1903	132,242	21,701,575	54.7	164.10
1904	131,818	21,794,960	58.8	165.34
1905	116,733	22,146,241	59.6	189.72
1906	112,165	19,446,769	59.5	173.38
1907	114,701	21,085,081	61.7	183.83
1908	115,829	17,311,808	52.7	149.46
1909	149,992	15,833,577	51.0	105.56
1910	170,789	17,404,922	43.6	101.91
1911	165,650	16,141,340	40.5	97.44
1912	154,047	16,283,510	32.3	105.70
1913	144,576	23,024,744	43.2	159.25
1914	132,873	22,375,106	44.8	168.39

[a] One metric ton equals 2,204.62 avoirdupois pounds.

During the whole history of the abacá industry, the fiber has been identified with the Philippines. This is due to the fact that the introduction of the abacá plant into other tropical countries, in both the Eastern and the Western Hemispheres, has not resulted in any considerable degree of success, and the fiber is still, as it always has been, distinctly a Philippine product.

Distribution.—Abacá is distributed throughout the greater part of the Philippine Archipelago. The provinces and islands which are most favorable for the growth of the plant and where the greater part of the commercial fiber is produced are the following: Southern Luzon, comprising the Provinces of Ambos Camarines, Albay, and Sorsogon; Leyte, chiefly the northeastern and southern parts; Samar, chiefly the northern and southeastern parts; and Mindanao, comprising the Provinces of Moro, Misamis, Surigao, and Agusan. The plant is also cultivated to some extent in the Islands of Negros, Cebu, Mindoro, Panay, and Marinduque. The most northern limit of the cultivation of abacá is central southern Luzon, comprising the Provinces of Cavite, Laguna, and Batangas.

During the fiscal year ending June 30, 1913, the total area under cultivation in abacá throughout the Philippine Islands was about 909,849 acres, distributed among the provinces as follows: Albay, 219,155; Ambos Camarines, 171,018; Sorsogon, 157,815; Leyte, 110,948; Samar, 68,143; Moro, 48,254; Misamis, 35,167; Surigao, 14,376; and the remaining provinces, 84,973.

Climate and soil.—The structure of the abacá plant and its habits of growth are such that a large and constant supply of moisture is required. The most important abacá provinces have, as a rule, a heavy and evenly distributed rainfall. The actual amount of rainfall required by the abacá plant is not very large, but it is essential that it be evenly distributed throughout the year. In districts having a long and pronounced dry season, irrespective of the annual amount of rainfall, the cultivation of abacá can not be successfully carried on unless water is available for irrigation.

The abacá plant requires a warm climate, and for this reason its successful cultivation can be accomplished only in tropical countries and below an elevation of 1,000 meters (3,280 feet.) Cold climates are detrimental to the plant, both in regard to the extent of its growth and the development of its fiber. Extreme heat, on the other hand, appears to affect the plant unfavorably, probably because it causes excessive and rapid evaporation of moisture both from the leaves and the soil, especially during the driest period of the year.

Abacá (manila hemp), Sinaba and Tangongon varieties, Davao, Mindanao.

The abacá plant with its heavy broad leaves is very often seriously injured by strong winds. It is, therefore, always desirable to select localities which are naturally protected from such winds, especially in all provinces lying within the typhoon belt. If natural barriers are not available, windbreaks must be planted along the exposed side or sides and also at intervals among the plants.

Next in importance to favorable climatic conditions is the selection of a suitable soil. The suitability of any particular type of soil of necessity depends, on the one hand, on the climatic conditions, and on the other, on the location. For instance, in a certain location where the land is low and where a heavy rainfall occurs, a certain soil would become oversaturated, while the same type of soil, if the land were higher and the rainfall less abundant, might be sufficiently well drained.

Throughout the important abacá districts the plantations are situated on the lower slopes of volcanoes or other mountains. The soils in such locations are, as a rule, deep, fertile, and well drained. Besides being well drained, the soil should be of lasting fertility, as abacá is grown on the same land for a period of ten to fifteen years without replanting, rotation, or fertilization. This exposes the soil to a long drain on its resources. Besides having lasting fertility, the soil should also be of medium consistency so as to allow the plant to benefit by the constant supply of moisture without the soil becoming oversaturated.

Description of the plant.—The abacá is a perennial plant 5 to 10 meters (16½ to 33 feet) high. When mature it consists of a group, or cluster, of from 12 to 30 or more stalks of different stages of development. The stalk is cylindrical, 2½ to 6 meters (8 to 20 feet) long, and is formed by the overlapping of the leaf sheaths. The sheaths grow from the fleshy, central core, which is the real stalk, until the sheath formation is completed, when the flower bud developes and forms the flowering spike. The flowers are borne in clusters subtended by a large membranous bract. The first few bracts which subtend

Eleven-months-old abacá plant, Laguis variety of Leyte, at La Carlota experiment station, Occidental Negros.

the real flowers are larger and more conspicuous than the rest which subtend the false flowers. The latter bracts are so densely laid upon one another as to form a kind of flower cone. This cone is smooth, glossy, and of a color ranging from purple to light green. The fruit is green, 5 to 6 centimeters (2 to 2½ inches) long, 1½ to 2 centimeters (0.59 to 0.78 inches) in diameter, inedible, and filled with black seeds.

The abacá plant closely resembles the banana. To the inexperienced eye, it is rather difficult to distinguish the one from the other. The abacá is ordinarily smaller than the banana and its stalks are, as a rule, more slender than those of the latter. The abacá leaf is darker green, narrower, and more tapering than that of the banana. The petiole (leaf stalk) of the abacá leaf is of a light-green color, while that of the banana is grayish.

Stalk formation.—The abacá stalk consists of a fleshy central core and a number of overlapping sheaths. This core is a continuation of the fleshy part of the rootstock, and, as it grows, sheaths are formed on its sides, chiefly at the base. When the stalk reaches maturity sheath formation stops, but the core keeps growing and forms what is known as the "flower spike." The central core, therefore, is really the flower stalk, and its sheaths are prolongations of the petioles of the leaves. This core diminishes in diameter as it rises in the middle of the stalk. Its diameter at the base of the stalk varies from 15 to 35 centimeters (6 to 14 inches), and at the top it rarely exceeds 5 centimeters (2 inches).

The stalk consists of 12 to 25 sheaths, depending on the variety and the extent of growth. The central sheaths alone are exactly the same length as the stalk. The exterior sheaths rise from the base of the core but do not extend to the top of the stalk, and the interior ones, which extend to the top of the stalk, do not rise from the base but at variable intervals above it.

Fiber extraction.—The abacá plant when mature consists of a group of 12 to 30 stalks. These stalks are in all stages of development, but usually two to four only can be harvested at the same time. The stalk is mature at the time of the appearance of the blossom, or shortly before. As a rule no cutting should commence before the plant is 2 to 3 years old. After the first harvest subsequent cuttings can be made every four or six months.

The process of fiber extraction consists of two distinct operations: First, the removal of the ribbon-like fibrous strips from the sheath; and, second, the separation of the individual fibers by pulling these strips under a knife.

The laborer, sitting on the ground with a stalk in front of him, inserts a small, sharp piece of bone or bamboo into the sheath, separates the fibrous strip and pulls it off in two to four ribbons, varying from 5 to 8 centimeters (2 to 3.14 inches) in width and as long as the sheath itself. When these ribbons have been separated, the remainder of the sheath is removed and thrown away as waste. Each consecutive sheath is thus worked until the central core of the stalk is reached.

When a sufficient quantity of these fiber strips, or ribbons, has been collected, they are tied in bundles and carried to the stripping apparatus, which consists of a log set in a horizontal position ½ to 1 meter (1½ to 3 feet) from the ground, on top of which is fastened a level block of smooth, hard wood or bamboo. Over this block is placed a knife about 30 centimeters (12 inches) long with a handle 40 centimeters (16 inches) long. Every strip is passed under the knife twice, the second time to pull the butt end which the operator holds in his grasp during the first pull. This process of drawing under the knife removes all the pulp, leaving in the hands of the operator a bunch of clean, white fiber. As soon as the strips are cleaned, the fiber is hung over a bamboo pole to dry.

Practically all of the fiber produced in the Philippine Islands is extracted with this simple apparatus. The strength and color of the fiber—two most important qualities—are determined largely by the manner in which it is cleaned. Three factors in the process affect the quality of the product—the condition of the knife blade, the degree of pressure with which the knife is held upon the block, and the manner of drying the fiber. With a serrated knife loosely fastened the fibers are only partially separated and only a portion of the pulp is removed, the work is easy, the yield large, but the fiber is inferior in quality. With a knife having a smooth-edged blade and held firmly on the block, the work of extraction is somewhat more difficult and the waste greater, but a very superior fiber is obtained. Prompt and thorough drying will give the fiber its white and lustrous color.

Yield and value.—From 400 to 500 abacá plants are usually planted to the acre. Each plant, or hill, consists of several stalks, three to five of which can be harvested annually. The yield of fiber per acre varies considerably, but under normal conditions and by proper treatment an average of one-half ton of dry fiber can be obtained. The quality of the fiber also varies considerably depending on the amount of care taken in cleaning the fiber and in handling it prior to and after extraction. The average quality, however, should be at least "good current," which at the present writing is valued at ₱440 ($220) per ton in Manila.[1] The gross income from an acre of land planted to abacá at the present time may therefore be estimated at ₱220 ($110). The normal value of "good current" abacá may be placed at ₱400 ($200) per ton, thus making the gross income from 1 acre during normal times at about ₱200 ($100).

The cost of bringing to maturity 1 acre of land planted to abacá is estimated at ₱100 ($50), including rental of land, clearing of forest, wages and salaries, and other expenses. The cost of subsequent cultivation is estimated at ₱10 to ₱12 ($5 to $6) per acre. The cost of harvesting, fiber extraction, and marketing of the product ranges from ₱175 to ₱200 ($87.50 to $100) per ton, or ₱87 to ₱100

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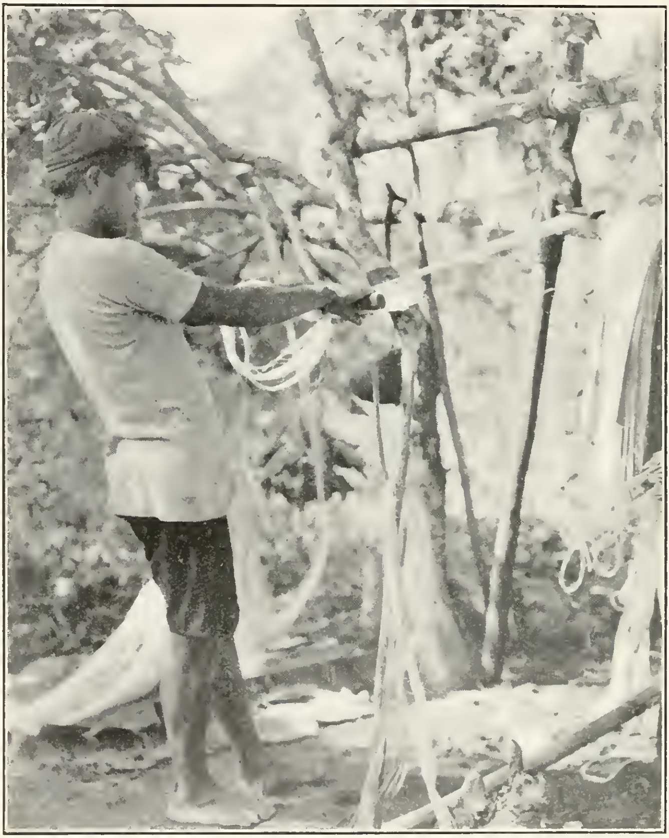
[1] Written before the outbreak of the present European war.



Stripping abacá (manila hemp), second process, Davao, Mindanao.

($43.50 to $50) per acre. During normal prices the net income will be about ₱90 ($45) per acre per annum.

Description and uses of the fiber.—Abacá fiber is very light, strong, and durable. When properly extracted and dried, it is also of a white, shining color.

It divides easily into smaller fibers of a regular diameter. The central cavity, or lumen, is both large and apparent. The walls of this cavity are of uniform thickness, and its form generally resembles the form of the whole fiber, which is in most cases oval. The end of the fiber tapers gradually and the point is acicular or slightly rounded.

The chief uses made of abacá are in the manufacture of marine cordage of various sizes and grades, oil-drilling rope, binder twine, trawl twine, tarred lathe, and tagal braid and textiles.

The manufacture of marine cordage takes the bulk of abacá fiber, perhaps not less than 75 per cent of the total production. The grades of the fiber used for this purpose depend on the grade of the rope made, and also on the country where the rope is manufactured. The United States uses higher grades of fiber than Great Britain and other European countries.

In the manufacture of oil-drilling rope only the higher grades are used, perhaps little or none under "good current."

The use of abacá in binder twine has recently been declining due, first, to the scarcity of the middle and higher grades of abacá and their consequent rise in price; and, second, to the increase in the production of henequen and other sisal fibers, which are more uniform in quality than abacá, and which, though not as strong and durable as the latter, yet are strong enough for binder twine. Perhaps not more than 10 per cent of the total supply of abacá is now being used for binder twine.

Trawl twine is made from abacá of the grades good current and above. For this purpose the fine and soft fiber is particularly required.

Tarred lathe is made of the lower grades of the well-cleaned (soft) abacá, and such ropes are used for hauling lumber at the lumber mills, and for other similar purposes.

The manufacture of tagal (hat) braid is of a comparatively recent origin. Only the highest grades of abacá are used for this purpose, and Japan is by far the largest buyer of the raw fiber. Some European countries buy these high grades, knotted and twisted into hanks, or rolled on bobbins or spools. About 4 or 5 per cent of the supply of abacá is used for this purpose.

Recent development of the industry.—From the early history of the abacá industry until the present time the production of fiber has increased steadily. Unfortunately, however, this increase in production was not the result of, nor was it accompanied by, any general improvement in the cultivation of the plant or in plantation management. Until a short time ago, and in a large measure even at the present time, the bulk of production is the product of small plantings in which old and crude methods of cultivation and fiber extraction have been used. Under such conditions, therefore, it is not surprising that for a long time it was the belief that the cultivation and production of abacá was not an industry that could be profitably carried on by the use of systematic and modern methods of agriculture.

Since 1903, however, several large plantations have been established in different localities and improved methods used in the cultivation of the plant and in general management. The results have shown that the abacá industry can be made one of the most profitable branches of investment for the tropical agriculturist. The abacá plant responds freely to careful and methodical treatment by a considerable increase in the yield of fiber, and the carefully extracted fiber commands a steady demand and a high price, even during the so-called dull periods of the market. As a result of this investigation there has recently been a tendency toward the substitution of modern methods of culture and management to replace the former wasteful and antiquated practices.

The opportunities for the extension of the abacá industry of the Philippines, not so much in an increase in the area cultivated or an increase in production, but in an increase in the yield of plants and an improvement in the quality of the product, are very promising. Improved methods of culture and fiber extraction will largely increase the production of fiber on some of the land already cultivated, while large areas now covered with forest are in every way suitable for abacá and are available for prospective planters. With but little or no danger from insect pests or plant diseases and with but little or no competition from other countries, abacá is an eminently safe crop and affords one of the most profitable branches of agriculture in the Philippines.

Further information on this subject may be obtained from the director-general of the Philippine Exposition Board, Panama-Pacific Exposition, or by application to the Director of Agriculture, Manila, P. I.

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THE PHILIPPINE ISLANDS

TOBACCO

PANAMA PACIFIC
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TOBACCO IN THE PHILIPPINES

By H. O. Jacobson, *Chief, Division of Agronomy, Bureau of Agriculture*

MANILA cigars are perhaps more widely known than any other product of the Philippine Islands. Tobacco was introduced to these Islands during the last quarter of the sixteenth century by the Spanish missionaries coming here from Mexico, but the growing of tobacco did not assume the proportions of an industry until 1781, when Governor-General Vasco decreed that the Government should have control of the production, manufacture, and sale of this product.

By this decree a monopoly was created which remained in operation a hundred years. This monopoly strictly supervised the growing and grading of the leaf and had factories in Manila for the manufacture of cigars, cigarettes, and smoking tobacco. In the field the chief appraiser, styled "interventor," residing at the provincial capital, had a force of subordinates known as "alumnos aforadores." These were in charge of districts composed of municipalities and in each municipality there was a "caudillo" (head man) who was also the "gobernadorcillo" (little governor), who, by the aid of his "tenientes" (liutenants or overseers), supervised the growing of tobacco, being remunerated for this service by a percentage of the crop produced.

The chief appraiser set the date when the first seed beds were to be sown and also determined the date of planting and number of subsequent seed beds. The program laid out by the chief appraiser went into considerable detail, even designating the number of plowings and when they should be done, as well as the number of plants to be set out in a unit of land.

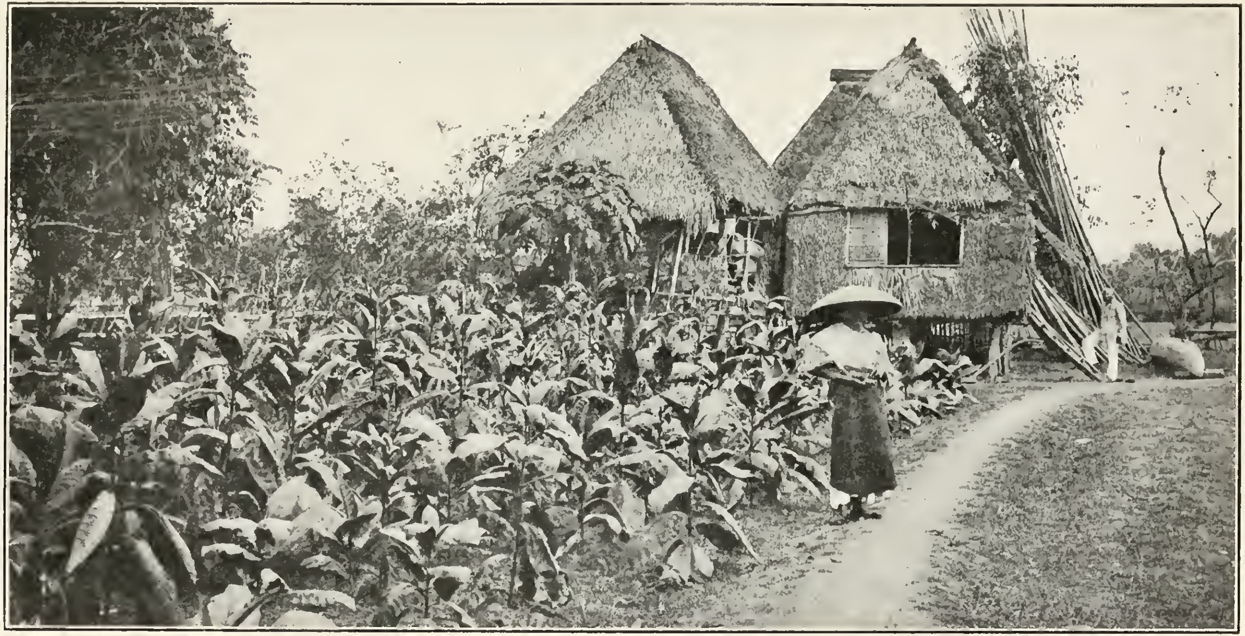
Later on in the season supervision was exercised in the harvesting and curing of the leaf, and when the crop was ready for market the grading was painstakingly done by the government representatives. Severe penalties were inflicted upon growers who failed to deliver tobacco of sufficiently good quality. This penalty often consisted of the confiscation and burning of the crop, and the cancellation of the leasehold held by the "colonista," or tenant.

The tobacco monopoly, due to the strict enforcement of regulations, especially in the earlier period of its operation, secured for Philippine tobacco an enviable reputation for quality, but due to corrupt practices adopted by the subordinate officials later on, the unrest and dissatisfaction of the growers led to strife and riots, so that it was finally decided to dissolve the organization, despite the fact that even in its last year of operation it had yielded the Government $1,500,000 of revenue.

The tobacco monopoly throughout its entire period of existence was the chief source of income for the local government and was a means of relieving the Government of Mexico of the burden which these Islands had been to it.

In 1808 the revenue derived from the monopoly amounted to 500,000 duros (Spanish gold dollars) and in 1866–67 the large amount of 8,418,939 Spanish gold dollars was turned into the local treasury. In fact, the local officials were enabled to send "home" large amounts to compensate in part the Spanish Government for previous expenditures and advances.

It was believed at the time the Govermnent tobacco monopoly was abolished, that when the growers were freed of the so-called oppressive supervision the quantity of tobacco would be largely increased and the quality raised, through the growers' efforts to profit thereby, actuated by self-interest. This theory was later found to be unsupported by fact.



Growing tobacco on the Island of Luzon.

In 1883 a large commercial concern known as the Compañía General de Tabacos de Filipinas was organized with a capital of $2,500,000. This concern built a large cigar and cigarette factory, named "La Flor de la Isabela," and by virtue of circumstances was enabled to purchase the greater part of the first crop of tobacco grown without Government supervision, virtually stepping into the position formerly occupied the Government monopoly. This company acquired huge tracts of tobacco lands and populated these lands by acting as immigration agents. Other companies have since entered the field, but the above-named concern still continues to be the largest operator in the tobacco industry in the Philippine Islands.

As would naturally occur, when tobacco was first introduced, the localities for producing the crop were selected in a haphazard manner, but eventually it was learned that the valley of the Cagayan River, a region lying between two mountain ranges situated in the northern part of the Islands of Luzon, was peculiarly adapted to the production of high-grade tobacco.

This valley contains a tobacco-land "belt" about 150 miles in length and varying in width up to 10 miles. The valley is inundated annually to a depth of from 5 to 40 feet, the consequent annual deposit of silt amounting to several inches in thickness. This section is known as first-class tobacco land. Back of these lower levels are the second-class lands which are inundated only under exceptional conditions whenever unusual rainfall occurs. The fame of the Cagayan Valley is so firmly established that the initiated person unconsciously couples that name with Philippine tobacco.

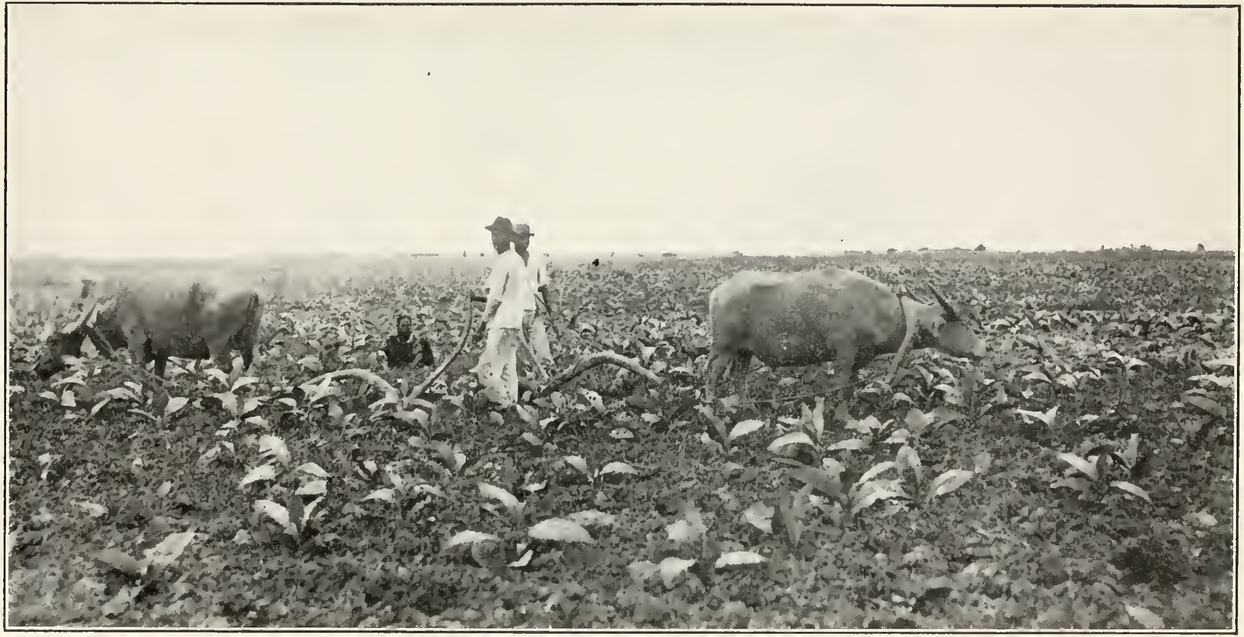
While tobacco is now grown in almost every province, the following rank highest in area devoted to the industry in the order named: Isabela, Cagayan, Pangasinan, Cebu, La Union. They contain 78 per

Tobacco seed selection, Ilagan, Isabela.

cent of the total area planted with tobacco and produce about 84 per cent of the total crop, while the Cagayan Valley alone contains about 42 per cent of the total area devoted to tobacco and produces half of the annual crop.

Culture.—The crop is grown by the aid of very primitive implements and elementary methods. In the Cagayan Valley, for instance, the seed beds are sown in October, November, and early December. Little protection is given the tender seedlings, it being purely a case of the survival of the fittest. As soon as the fields are sufficiently dry they are plowed twice—sometimes thrice—with small native plows and are then harrowed with bamboo harrows. The plants are set out at the average rate of 4,000 plants per acre. This work is done by hand, transplanting machinery being unknown. Weeding by hand is done twice, the weeds being laid between the rows; sometimes a plowing is given. Suckers are not removed and budding is done once. The leaves are picked one by one as they ripen and strung on bamboo sticks about a yard long and of the diameter of an ordinary lead pencil; the whole plant, with the leaves attached, is sometimes taken. The leaves are then dried in the sun, and when dry are piled in heaps under shelter and repiled whenever the heat generated becomes too great, usually at intervals of three or four days. The leaves are next removed from the bamboo sticks (palillos) and made up into hands (manojos), in which shape they are taken over by the buyer and are further fermented and then placed in warehouses.

Approximately 80 per cent of the crop in the Cagayan Valley is now produced by owners of small tracts of land held under questionable titles. These people did not obtain the expected relief when the Government monopoly was abolished because, lacking organization, they became dependent upon the



Cultivating tobacco, Ilagan, Isabela.

small independent dealers, mostly Chinese, who established themselves in the territory and became the money lenders and local financiers. To this day the small farmer obtains credit for food, etc., by agreeing to return to the local merchant a given unit of tobacco for an equivalent unit in rice or other food product, thereby establishing an arbitrary price for his product irrespective of its quality or intrinsic worth.

The economic condition of the tobacco producers as well as the other workers in the industry was taken up for consideration very early in the history of the American administration in the Philippine Islands, resulting in part in the passage in 1909 of the Payne Tariff Bill, which created a preferential market for not to exceed 150 million cigars annually.

The importance of this act was never fully realized by the cosmopolitan tobacco manufacturers of Manila and consequently no concerted action was taken by them to educate the American smoker in the United States with respect to the excellent qualities of the better grades of Philippine cigars. Representative of the large distributing agencies in the United States took steps to provide every reasonable means for popularizing the product and offering it to the trade there, but not knowing prevailing business methods in the Orient, they became involved in misunderstanding which later developed into a systematic campaign of opposition to the wider use of the Philippine product in the United States.

It is safe to say that had the Philippine manufacturers fully realized the necessity of meeting the United States demand on the basis on which the American buyer is accustomed to doing business and had they systematically organized the business of supplying the American demand from Manila, the Manila cigar and cigarette would to-day enjoy the reputation with the American smoker to which it is justly entitled. As it is, the average American smoker does not know the true enjoyment obtainable from a better-grade Manila cigar.

To be charitable, let us say that the unfortunate result was due to mistakes and misunderstanding on all sides and let us hope that eventually the Philippine product will be known for its merit on an equitable basis for comparison.

Tobacco leaf in marketable form.

An addition to the peculiarly pleasing bouquet or aroma of the better Philippine tobacco is its characteristic of not cloying the appetite of the smoker, as it does not produce that heavy feeling of satiation so marked after smoking the Havana tobacco.

The Filipinos are large consumers of tobacco mostly in the form of cigarettes, which are smoked by both sexes of all ages.

In this connection it should be stated that the cigarettes made and consumed here are composed of pure tobacco, without any adulteration whatever, and the rice paper is free from deleterious residue, due to bleaching processes. It is a commonly conceded fact that the cigarettes locally consumed have no such harmful effect as is popularly attributed to cigarettes in the United States.

The present annual consumption of cigarettes in the Archipelago exceeds four and half billion, on which the consumers pay to the Government approximately $2,250,000 as internal-revenue tax. The local consumption of cigars is indicated in the first column of the table given below. These figures are taken from the Ninth Annual Report of the Collector of Internal Revenue for the Philippine Islands:

Cigars manufactured during the fiscal years 1906 to 1913, inclusive

Fiscal year ended June 30—	Consumed in the Philippine Islands.	Exported to foreign countries.	Shipped to United States.	Total.
1906	74, 184, 537	94, 110, 336	231, 206	168, 526, 079
1907	79, 476, 459	117, 684, 485	82, 175	197, 243, 119
1908	82, 986, 278	115, 738, 939	29, 570	198, 754, 787
1909	86, 800, 520	116. 981, 434	867, 947	204, 649, 901
1910	89, 272, 890	109, 006, 765	87. 281, 673	285, 561, 328
1911	96, 115, 525	104, 604, 170	27, 531, 596	228, 251, 291
1912	109, 924, 014	104, 476, 781	70, 518, 050	284, 918, 845
1913	96, 193, 811	106, 563, 541	102, 894, 077	305, 651, 429

It should be noted that the total production of cigars has nearly doubled in seven years.

As was confidently expected, the Payne Tariff Bill has increased the volume of trade between the Philippine Islands and the United States. The following table, showing the distribution of exported cigars, also shows the increased number taken by the American market:

Distribution of cigars exported from the Philippines during the fiscal years 1911 to 1913, inclusive

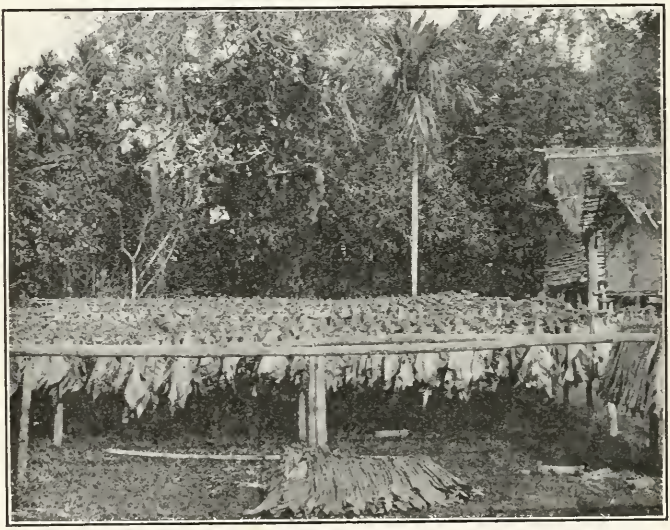
Country to which exported.	Total exports during the fiscal year—		
	1911	1912	1913
United States	27, 531, 596	70, 518, 050	102, 894, 077
China	38, 664, 018	38, 300, 939	37, 051, 134
Straits Settlements	15, 136, 940	17, 626, 011	18, 830, 027
Australia	13, 366, 884	12, 036, 937	13, 546, 320
England	8, 791, 063	8, 651, 075	8, 203, 132
Spain	7, 834, 900	9, 484, 019	7, 850, 400
India	3, 076, 746	3, 174, 101	3, 702, 630
France	2, 377, 320	1, 004, 600	3, 302, 000
Java	1, 801, 885	1, 904, 840	2, 399, 230
Germany	2, 367, 800	1, 991, 487	1, 941, 192
For consumption on high seas	1, 899, 957	1, 829, 285	1, 412, 460
New Zealand	628, 946	685, 250	781, 409
Belgium	612, 475	828, 991	739, 275
Holland	950, 575	737, 625	715, 745
Japan	359, 886	1, 124, 075	697, 250
Scotland	828, 800	498, 692	667, 275
Canada	575, 184	478, 525	574, 000
South Africa	1, 541, 000	1, 241, 000	550, 536
Indo-China	435, 050	498, 375	523, 305
South America	185, 300	136, 400	464, 625
Gibraltar	1, 025, 000	640, 000	427, 500
Italy	533, 500	430, 000	382, 250
Siam	328, 200	312, 650	313, 761
Canary Islands	220, 000	130, 000	278. 000
Korea	152, 850	194, 055	262, 460
Egypt	169, 607	107, 400	234, 300
Denmark	182, 000	90, 000	215, 000
All others	558, 284	340, 449	498, 325
Total	132, 135, 766	174, 994, 831	209, 457, 618

Cigarettes do not as yet enter so largely into the export trade. The number and their distribution is shown in the following table supplied by the Bureau of Internal Revenue:

Exports of Philippine cigarettes, fiscal years 1911 to 1913, inclusive

Country to which exported.	Total exports during the fiscal year—		
	1911	1912	1913
China	22,035,765	26,901,575	29,141,939
United States	8,387.900	3,061,900	14,246,250
For consumption on high seas	2,170,750	3,094,760	3,709,050
Straits Settlements	1,453,250	1,198,500	1,466,500
Japan	220,220	511,870	663,288
India	350,650	399,340	451,881
Guam	285,000	150,000	345,200
Caroline Islands		223,350	203,500
All others	522,330	235,465	1,204,230
Total	35,425.865	35,776,760	51,431,838

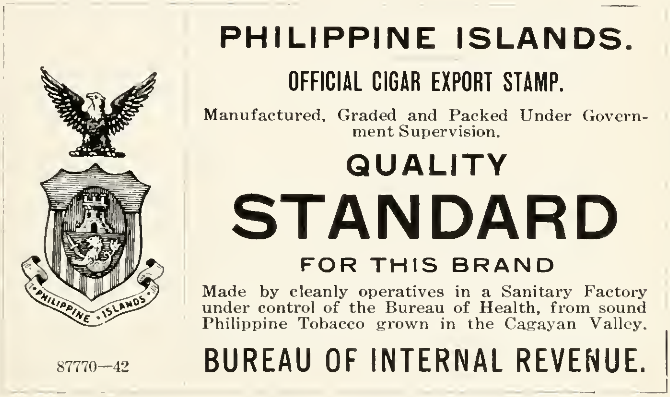
During the fiscal year ending June 30, 1913, the total amount of leaf tobacco sent to the United States amounted to 92,500 pounds, in round numbers.



Tobacco-curing racks.

Upon the approval of the Payne Bill, August 10, 1909, in order to protect the anticipated trade and to guarantee the quality of the goods to the American importer and consumer, the Philippine Government provided regulations for the grading and labeling to be done under the direction of the Bureau of Internal Revenue.

To cigars and cigarettes the accompanying label was attached:



PHILIPPINE ISLANDS.

OFFICIAL CIGAR EXPORT STAMP.

Manufactured, Graded and Packed Under Government Supervision.

QUALITY

STANDARD

FOR THIS BRAND

Made by cleanly operatives in a Sanitary Factory under control of the Bureau of Health, from sound Philippine Tobacco grown in the Cagayan Valley.

87770—42

BUREAU OF INTERNAL REVENUE.

Facsimile of internal-revenue stamps for Philippine cigars and cigarettes. The words "selected" and "below standard" are substituted for the word "standard" where the stamp is affixed to these grades.

The rules defined the grades, and for cigars of "standard" grade the following was required: "To be made of good, sound, and clean tobacco, exclusively from the Provinces of Isabela and Cagayan, well made, with suitable wrappers, and neatly and properly packed."

During 1907, in order to encourage the planters to increase the production of tobacco and to improve the quality thereof, the Philippine Commission passed an act providing for bounties to be paid to tobacco growers. This act was amended two years later, increasing the amount of the annual appropriation. Prizes were offered to the farmers to be awarded on a competitive basis. These acts were subsequently made inoperative, being found nonproductive of the much-to-be desired results.

It is is said that in 1910 there were some 300 cigar and cigarette factories—most of these being small concerns—in operation in the Philippine Islands. In 1913 the Collector of Internal Revenue reports but 81 factories.

The lesser number is probably due to the enlargement of some factories and the organization of several new large concerns, these naturally tending to eliminate numbers of smaller factories. Other factors, such as the operation of internal-revenue laws and sanitary inspection, may also have had an influence in the matter.

There are approximately 40,000 operators engaged in the business of making cigars and cigarettes in Manila, a majority of whom are women. The cigarmakers are very skillful and dexterous and turn out a very superior article.

The annual production of tobacco and its value is given below in a table compiled by the division of statistics of the Bureau of Agriculture:

Tobacco production in the Philippines, fiscal years 1910 to 1913, inclusive

Fiscal years.	Area cultivated.	Quantity produced.	Average production per acre.	Average value of production per acre.	Total value.
	Acres.	*Pounds.*	*Pounds.*	*Dollars.*	*Dollars.*
1910	132, 510	61, 744, 303	466	28. 53	3, 780, 915
1911	170, 539	56, 257, 784	330	20. 20	3, 444, 948
1912	140, 948	65, 219, 646	463	28. 33	3, 993, 728
1913	170, 477	101, 545, 657	596	36. 47	6, 218, 153

The history of the product as an export is most graphically shown in the following tables, taken from the annual report of the Insular Collector of Customs:

Exports of cigars, cigarettes, and other tobacco, fiscal years 1899 to 1913, inclusive

CIGARS

[Values given in U. S. currency.]

Fiscal years.	To all countries.			Percentage of total exports.
	Quantity.	Value.	Average value per thousand.	
	Thousand.			
1899	167,991	$1,294,653	$7.71	9.7
1900	219,098	1,189,942	5.43	5.4
1901	149,496	1,250,175	8.36	4.7
1902	225,420	1,666,822	7.39	6.0
1903	119,721	947,246	7.91	2.4
1904	104,803	968,869	9.24	2.6
1905	106,571	968,022	9.08	2.9
1906	93,136	904,250	9.71	2.6
1907	116,719	1,051,621	9.01	3.0
1908	117,564	1,084,078	9.22	3.3
1909	116,278	1,083,702	9.32	3.4
1910	196,192	2,973,630	15.16	7.4
1911	132,217	1,700,712	12.86	4.2
1912	175,320	2,660,061	15.17	5.2
1913	207,396	3,356,748	16.18	6.3

CIGARETTES

1899		$525		
1900		1,898		
1901	7,844	11,092	$1.41	
1902	7,189	9,995	1.39	
1903	20,503	20,699	1.01	
1904	11,804	12,566	1.06	
1905	18,275	16,404	.90	
1906	18,892	16,801	.89	
1907	152,777	104,268	.68	
1908	60,904	38,345	.63	
1909	53,614	34,518	.64	
1910	30,886	34,045	1.10	
1911	33,662	36,132	1.07	
1912	34,955	32,488	.93	
1913	52,040	57,582	1.10	

Exports of cigars, cigarettes, and other tobacco, etc.—Contd.

ALL OTHER TOBACCO

Fiscal years.	Quantity.	Value.	Average value per ton.	Percentage of total exports.
	Tons.			
1899	6,679	$917,536	$137.38	6.7
1900	9,167	989,439	107.93	4.5
1901	8,968	956,451	106.65	3.6
1902	10,924	824,650	75.49	3.0
1903	10,374	913,815	88.09	2.3
1904	9,571	1,031,832	107.81	2.8
1905	8,673	1,011,612	116.64	3.1
1906	10,735	1,468,839	136.83	4.4
1907	15,066	1,973,305	130.98	5.7
1908	11,633	1,592,123	136.86	4.8
1909	11,827	1,674,033	141.54	5.4
1910	10,935	1,629,820	149.05	4.1
1911	13,765	1,868,723	135.76	4.6
1912	13,832	1,902,644	137.55	3.7
1913	14,671	2,039,726	139.03	3.8

Prospects.—There are still large areas of undeveloped tobacco lands in the Cagayan Valley and the land now in cultivation can be made to produce both larger and better crops than at present.

In the course of time, if other means of transportation become available, there is likely to be a decided movement of population into this valley, which is now largely prevented by the very expensive and slow methods of reaching this part of the Islands. Practically all cargo, and travelers as well, now enter from the north, arriving there by ocean-going vessels, then proceed up the river in shallow-draft boats, the progress of which is frequently impeded by sand bars.

It is believed by some that a system of agricultural credit must be put into operation in order to enable the small farmer to improve his economic condition so that he in turn can devote more time and energy to the improvement of his product. Coupled with this idea is that of having the grades determined by representatives of the Government, these officials to exercise a general supervision and to act as referees between the buyer and seller and, in addition, to assist in a general educational campaign.

Full-grown tobacco plant.

The tobacco grown in the Philippines can, of course, be considerably improved by seed selection, better cultivation, more careful harvesting, and by the adoption of improved methods of curing and fermenting.

Since the present product is so good in spite of present practices and the obstacles presented, it appears that when these are removed, the Philippine product will easily make a position for itself from which it can with difficulty be dislodged.

Further information on this subject may be obtained from the director-general of the Philippine Exposition Board, Panama-Pacific Exposition, or by application to the Director of Agriculture, Manila, P. I.

BUREAU
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MANILA

OCT 8 1915

THE PHILIPPINE ISLANDS

COCONUTS

PANAMA PACIFIC
INTERNATIONAL EXPOSITION
SN. FRANCISCO CALIFORNIA

COCONUTS IN THE PHILIPPINES

By H. O. Jacobson, *Chief, Division of Agronomy, Bureau of Agriculture*

THERE are 45,000,000 coconut palms in the Philippine Islands. The value of the crop vies with abacá (manila hemp) for second place in annual crop value.

The palms are widely distributed throughout the Archipelago, the vast majority of them, however, being found south of the city of Manila.

The coconut, though it has been of wonderful importance and utility to the tropical inhabitant as a source of food and drink, has recently assumed a position of great consequence to the entire world.

From the coconut is made a comestible oil—an oil that is clean, wholesome, bland, and free from acids and withal inexpensive. With the constantly rising costs of animal fats, the adoption of the use of vegetable oils becomes necessary, and for this purpose there is no source of supply that equals the coconut.

The habitat of the coconut palm.—These palms prefer low levels, yet are occasionally found thriving at altitudes of 1,500 to 2,500 feet. However, since they are very sensitive to low temperatures, high altitudes are not favorable.

A uniform temperature ranging between 60° and 90° F. is essential. In addition, a well-distributed rainfall of from 50 to 80 inches or more per annum is required.

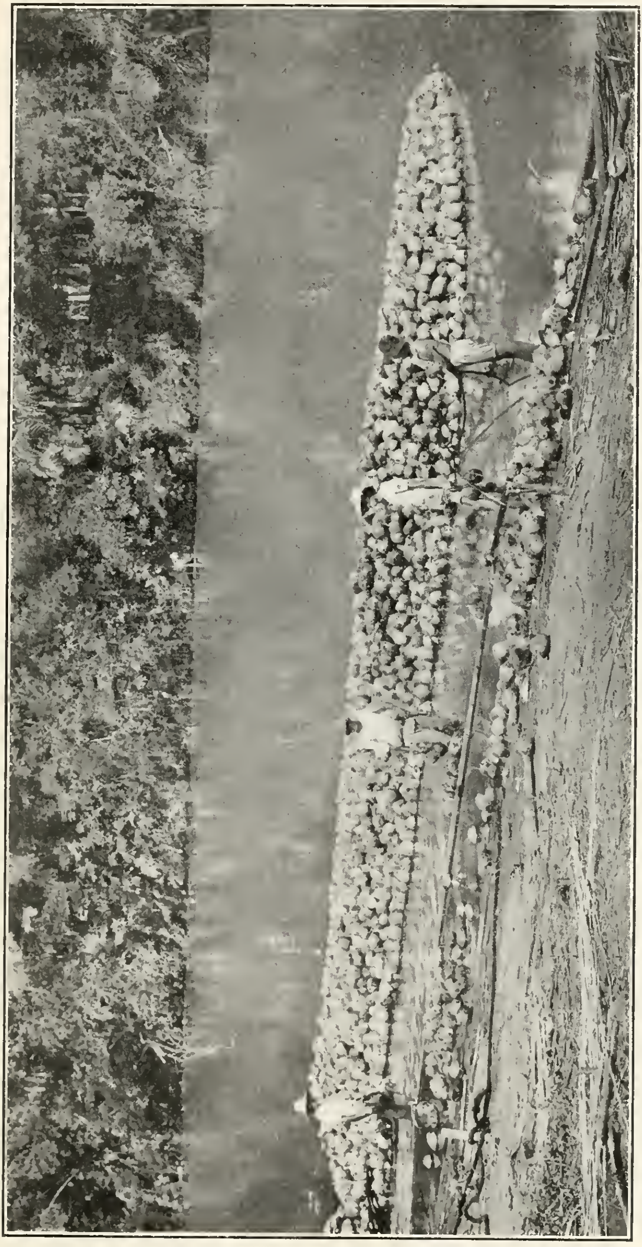
Soils.—Since the coconut palm does not have a taproot, nor do the lateral roots have root hairs, it therefore appears that a suitable soil must be friable, retentive of moisture, and highly fertile in order to secure normal development. The most productive groves are found on littoral or alluvial soils, yet this does not signify that comparatively heavy soils are not suitable, since with proper management these can be made to comply with all the above requirements. In the case of coconuts now found on heavy soils, there is seldom any effort made to provide for soil aëration, cover, or protection from unfair competition for plant food, due to weed growth.

The old superstition that the coconut must be near the sea is now exploded, but the belief is founded on apparently good reasons, which, however, have been found to be due to other causes than those which have been duly credited.

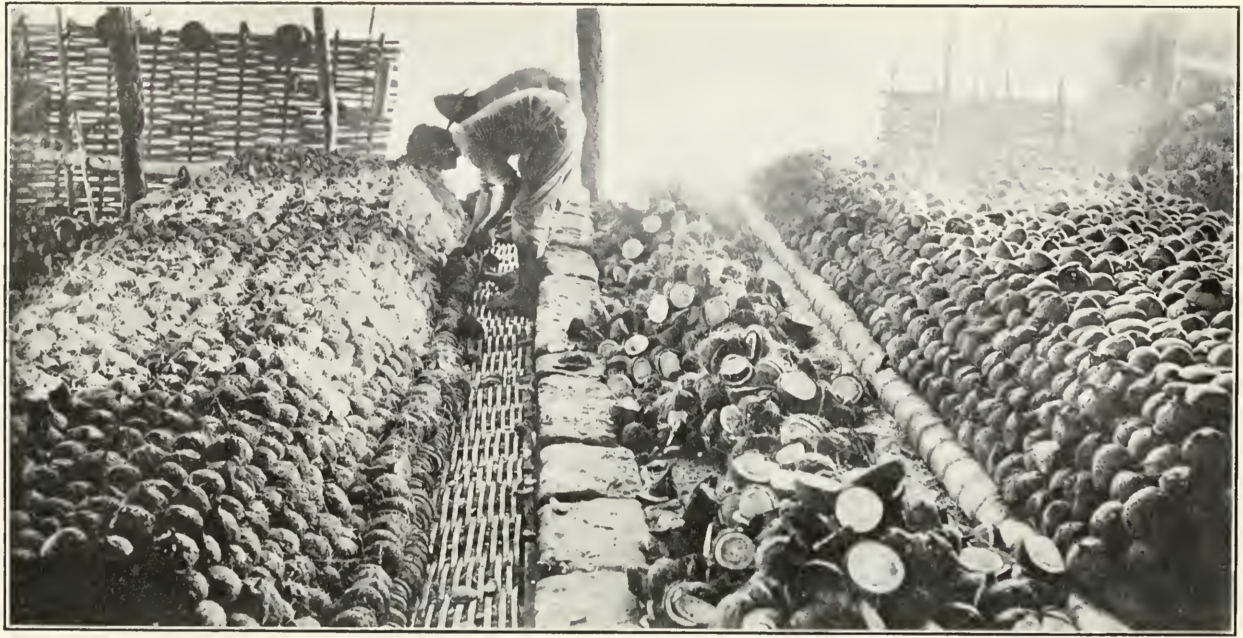
The coconut is sensitive to water supply, and naturally littoral soils are abundantly provided with soil water passing from the higher inland levels to the seashore, consequently

One-year-old palm properly treated.

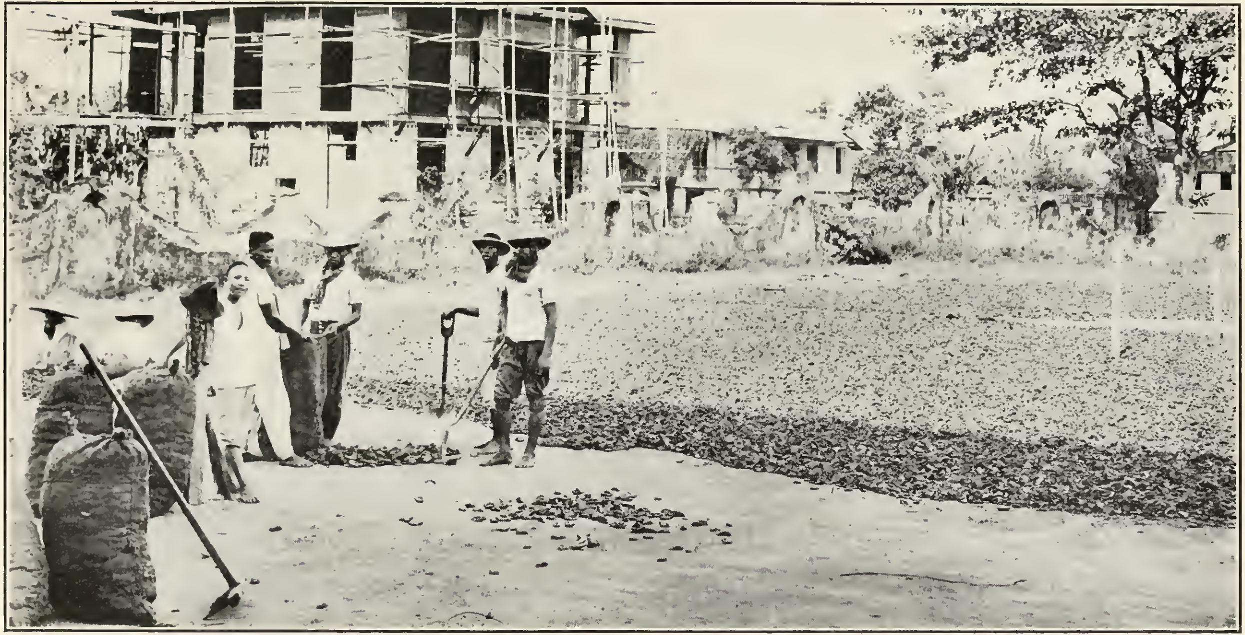
easily available to the roots of the coconut palms, hence the vigorous growth. Nevertheless, when free soil-water movement is found inland at low levels, and with favorable



Coconut raft.



Preliminary drying in making copra—tapahan method.



Sun-drying copra.

Coconut propagation.

temperatures and sufficient drainage, equally high development and productivity may be obtained.

Planting.—A complete description of the coconut industry

Coconut grove 25 years old.

would fill a book. Indeed, volumes have already been written. For our purpose it will serve to briefly describe ordinary methods.

Seed nuts should be selected from highly productive trees of good types. When ripe, these selected nuts should be carefully lowered to the ground. The nuts (retaining husks) are then placed in partly shaded seed beds or nurseries where they can be kept uniformly moist until germination takes place and sufficient plant growth is attained to allow their being placed in a permanent location.

The fields are prepared by removing the forest trees, underbrush, etc., then thoroughly plowing and fitting the field. Often, however, no plowing is done.

Lines are then laid and holes dug either according to the triangle, quadrangle, or quincunx plan, allowing about 50 palms to the acre. Native methods consist of more or less hit-and-miss planting with insufficient spacing, many plantations having as many as 200 palms per acre.

There is considerable difference of opinion as to the proper age at which seedlings should be set out, method of handling in that operation, and size of hole to be dug, etc. The practical planter must draw his own conclusions and pass judgment. Any progressive person can readily secure all the prevailing modern ideas on the subject.

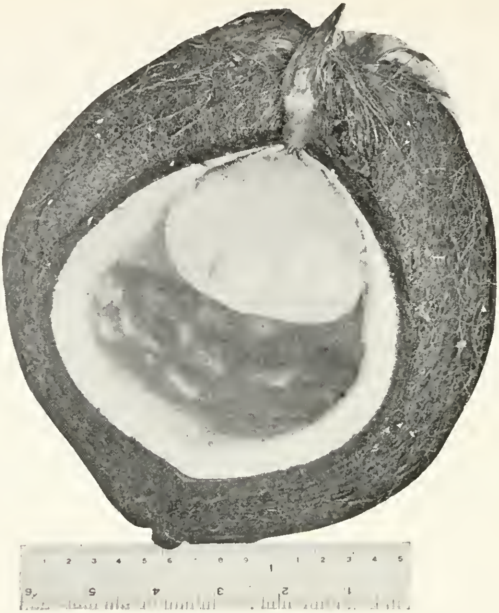
Culture.—Generally, culture has merely extended to cutting down the underbrush, even omitting this feature at times.

With the growth of the industry, however, modern agronomic practices are being introduced and in time more intensive culture with fertilization will be the rule, not the exception. The coconut palm responds handsomely to good treatment.

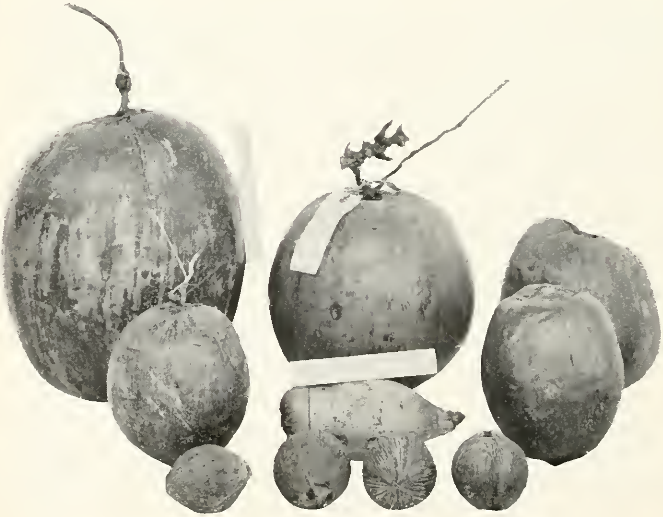
Harvesting.—When the nuts are mature they are either removed by hand, the harvester climbing the trunk of the palm, or by means of a hook attached to a long bamboo pole, by which the nuts are removed one by one. Another method, and one to be condemned, consists of cutting off the entire spathe or stem with the nuts attached, by means of a sharp curved cutting blade fastened to a long bamboo pole.

The nuts are then husked, removing the thick fibrous covering. This work may be done before the crop is removed from the grove or at the place where the nuts are further treated in manufacture. The husking is accomplished with the aid of a native plowpoint set in a tripod.

All the nuts not intended for direct consumption as food



Sprouting coconut.



Coconut varieties.

are made into copra (coconut meat partly dried). When the nuts are husked they are split open by means of a bolo (long, heavy-bladed knife) and subjected to heat sufficient to partly shrink the layer of meat away from the shell. Then the meat is removed from the shell and further dried.

Two methods of drying prevail in the Philippines; one is drying in the sun and the other by means of open fires in pits over which wooden gratings are placed. The copra is placed on the gratings and dried until the greater portion of its natural moisture content is removed. The open-fire method is objectionable, due to the deposit of creosote on the copra. The sun-drying method is fairly satisfactory, but unfortunately a climate highly desirable for producing coconuts is not suitable for drying copra. A standard machine for artificially drying copra has not yet been developed, but the problem is far from being insurmountable. The requirements of such a machine are controllable temperature, not to exceed 130° to 150° F., rapid removal of moisture, ease of manipulation, durability, and very low operating cost.

Sprouted coconut.

Copra is now made at extremely low cost for operation.

Under any scheme the shells should and will supply the necessary fuel.

It should be stated here that there are extant several styles of machines or apparatus for drying copra.

Transportation.—Because of the fact that the coconut plantations naturally are located contiguous to the sea, lakes, or rivers, the problem of transportation is quite easily solved. With the extension of railroads and metaled highways, which has taken place within recent years, considerable improvement has followed.

The coconuts (unhusked) are sometimes made into rafts and floated to market.

Markets.—Sixteen years ago but little attention was given here to the preparation of copra and the Spanish records make no mention of it as an export.

The following figures, taken from the reports of the Collector of Customs, indicate the growing importance of the product:

Export of copra

[Values in U. S. currency.]

Fiscal year—	Quantity.	Value.	Average value per metric ton.	Percentage of total exports.
	Met. tons.			
1899	14,047	$656,870	$46.76	4.7
1900	37,081	1,690,897	45.60	7.8
1901	52,530	2,648,305	50.42	10.0
1902	19,687	1,001,656	50.88	3.6
1903	97,630	4,472,679	45.81	11.2
1904	54,133	2,527,019	46.68	7.0
1905	37,557	2,095,352	55.79	5.6
1906	66,158	4,043,115	61.11	12.3
1907	49,082	4,053,193	82.58	11.8
1908	76,420	5,461,680	71.47	16.6
1909	105,565	6,657,740	63.07	21.1
1910	115,285	9,153,951	79.40	22.9
1911	115,602	9,899,457	85.63	24.9
1912	169,342	16,514,749	97.52	32.8
1913	113,055	11,647,898	103.03	21.9

NOTE.—The drought of 1912 affected the output of 1913. Also the opening of a large modern oil plant consumed a considerable quantity of copra which, therefore, does not appear on record as export under this heading.

One metric ton equals 2,204.62 avoirdupois pounds.

It is estimated that not less than 150,000,000 nuts are consumed annually for food. This amount, if converted into copra, would augment the figure by 30,000 metric tons, estimating that it requires 5,000 coconuts to produce 1 metric ton of copra.

About 50,000,000 nuts are made into oil in small antiquated mills operated by Chinamen and Filipinos and by home manufacture. In 1913 about 4,600 tons of oil were produced, of which 1,300 tons were exported. This oil is utilized for numerous purposes locally.

Approximately 250,000 palms are devoted to the production of tuba (fermented palm sap), of which over 11,000,000 gallons were produced in 1913. This product was valued at more than $1,000,000, the average price being $0.09½ per gallon.

Distribution of exported copra.—In the 1913 report of the Collector of Customs of the Philippine Islands we find that but 6.5 per cent of the copra went to the United States; other countries participated as follows:

Export of copra by countries, 1913

	Per cent.
United States	6.5
United Kingdom	2.2
Germany	13.5
France	60.9
Spain	8.1
Belgium	4.3
Denmark	.9
Mexico	.2
Japan	.7
British East Indies	2.7
Total	100.0

Desiccated coconut is not prepared in the Philippine Islands.

Production.—The leading coconut provinces, Tayabas, Laguna, Moro, Samar, Albay, Capiz, Misamis, Leyte, and Cebu, produce 80 per cent of the yearly crop. The first five provinces produce 60 per cent of the total. The total production for the Philippine Islands in 1914 will exceed 1,000,000,000 nuts.

The limit of production of coconuts on large areas has not yet been determined. A coconut palm sometimes bears a few nuts at 4 years of age, but worth-while crops will seldom be secured before the seventh year.

Mr. O. W. Barrett, formerly chief, division of horticulture in the Philippine Bureau of Agriculture, estimated that under good management production might be expected as follows:

	Nuts per palm.
Fifth year	10
Sixth year	40
Seventh year	60
Eighth year	80
Ninth year	100

Production per tree in the Philippines will probably not exceed 30 nuts per annum. This is due to too close planting and lack of culture and fertilization.

Individual palms are found, it is said, that produce 200 or more nuts per annum.

Tuba production.—From those palms devoted to the tuba industry the sap from the unopened flower buds is collected once or twice daily, the operator climbing a palm with a receptacle on his back and collecting the accumulated flow from each palm which is caught in a small bamboo-joint bucket attached to each bud. He passes from palm to palm on bamboo aërial walks and descends when the tour is completed.

This sap, when fresh, is a palatable drink and is sold locally as a beverage. The fresh sap contains about 12 per cent of sugar. When fermented, the product is highly intoxicating.

The average palm is supposed to produce 47.5 gallons of tuba per annum, valued at $4.50. Thus, 1 acre of 50 palms devoted to tuba production would yield $225, while if devoted to copra production would yield 5,000 nuts, or 1 ton of copra worth, at prices prevailing before the European war began, about $110. Of course, palms producing tuba do not at the same time yield coconuts.

By-products.—The most important by-product is the copra cake or "poonac," the residue from the presses when oil is made. This material contains from 2 to 6 per cent oil or more and is in great demand in Europe for stock food.

Very little coir fiber is made here as yet, although there is abundant raw material (coconut husks). This industry, however, requires very low labor costs in order to produce profits, and unless taken up as a household industry will probably not be a feature of consequence.

While the Filipino utilizes every part and portion of the coconut palm, aside from the fruit no other part of it has as yet any considerable value or commercial importance.

The potential possibilities of the fruit are so great and so little developed, comparatively speaking, that by-products need scarcely be considered.

Diseases, pests, and enemies.—When compared with other coconut-producing countries, the Philippine Islands are remarkably free in this respect. It is not the intention to convey the idea that diseases and pests are unknown, but all of those present can be handled and controlled, and as yet no general serious damage has been experienced.

Miscellaneous.—A freak coconut is known locally as "Macapuno." The Filipino distinguishes it by its heavier weight. These nuts, instead of being partly filled with "milk" when ripe, are more or less filled with "meat," which is devoid of the fibrous character of the normal coconut meat. This material is popular for making confections or desserts.

Coconuts ripen throughout the year.

Harvesting is done at periodic intervals, varying slightly from eight to twelve weeks. Six harvests per annum are considered quite sufficient.

A good laborer can husk 1,200 to 1,500 nuts per day, or can split three times that number.

There is one modern coconut-oil manufacturing plant now in operation in Manila; it is proposed to build another in Cebu in the near future.

Differing authorities estimate that the Philippines produce one-fourth to one-third of the world's copra output.

An estimate upon expenses for establishing a copra central on a plantation of 5,000 hectares (12,000 acres), prepared by Mr. O. W. Barrett, formerly chief, division of horticulture, Philippine Bureau of Agriculture, follows:

"In view of the fact that there is a strong and growing interest in coconut culture in the Philippine Islands, and at the same time a tendency to form combinations of plantations, or 'copra centrals,' it would seem expedient to furnish detailed estimates of the cost of establishing such centrals or large estates here.

"Unfortunately, it is practically impossible for the prospective coconut planter to lease or purchase bearing plantations anywhere in the Philippine Islands at present; on the other hand, there are unquestionable advantages and facilities in the way of his acquiring large areas suitable for the establishment of modern coconut groves.

"In this connection it should be borne in mind that while a small plantation may cost disproportionately high in the preparatory stage, larger estates cost relatively much less per hectare, both in the operating expenses and, if well managed, in the overhead charges. The returns from a copra central of, say, one-fourth or one-tenth the size of that under consideration in the following memorandum, should be only a little less, proportionately, than those from the large centrals. Just as with sugar cane, for instance, a certain amount of momentum, as it were, must be acquired by means of capital before the potential profitableness inherent in the system will be in evidence.

"The following estimates are based upon data gathered from reliable sources and are believed to be well within the limits of practicability. The figures here given are for a plantation in moderately good soil situated anywhere in the Philippine Islands outside of the typhoon belt.

"It is understood that 1,000 hectares (2,400 acres) of land are to be cleared the first year, 200 acres (480 acres) of this being set with abacá and 500 hectares (1,200 acres) with coconuts, 300 hectares (720 acres) being left for the central plant, roadways, villages for laborers, pastures, gardens, etc. The second year 2,000 hectares (4,800 acres) are to be cleared, and one-half planted with abacá (manila hemp) and one-half with coconuts. During the third and also during the fourth years 1,000 hectares (2,400 acres) are to be cleared and planted with coconuts. The trees are to be set in 'block' system (i. e., rows alternating 8 by 10 meters, or 20 by 32½ feet), 125 to the hectare (50 per acre).

Items of plant

Main office building (furnished)	$2,500.00	
Bungalow for—		
Director	1,500.00	
Agronomist	1,250.00	
Field superintendent	1,250.00	
Bungalows for 3 assistants, at $500 each	1,500.00	
300 cottages for laborers, at $37.50 each	11,250.00	
Warehouse	1,500.00	
2 churches, at $500 each	1,000.00	
4 schoolhouses, at $375 each	1,500.00	
3 tool houses	750.00	
Machine shop and storehouse	1,500.00	
Commissary building	2,000.00	
Hospital with furnishings	1,500.00	
50 kilometers woven-wire fence	10,000.00	
Tools and equipment including 3 traction engines, 6 donkey engines with drums, 12 complete stump pullers, 50 field harrows, 50 ordinary plows, 1 motor launch, and minor implements (axes, bolos, shovels, etc.)	37,500.00	
Work animals, including 50 carabaos, 100 cattle, 10 horses	12,500.00	
Live stock, including 200 brood sows and 10 boars	1,500.00	
Commissary goods and store stock	2,500.00	
Ice plant	1,500.00	
Water supply	2,500.00	
Dock and freight bodega (warehouse)	2,500.00	
		$99,500.00

Operating expenses, first year

Salaries of director, agronomist, superintendent, and assistants, including medical inspector, accountant, cashier, machinist, storekeeper, and assistants	$25,000.00		
Labor, 300 men, at $0.375 per day, with partial subsistence, averaging 20 days per month	30,000.00		
65,000 selected seed nuts	1,625.00		
220,000 abacá suckers, at $30 per 1,000 (delivered)	6,600.00		
Miscellaneous supplies	5,000.00		
General maintenance of plant	5,000.00		
Road construction	2,500.00		
Fence building	2,500.00		
Depreciation of stock and renewal of small items	5,000.00		
Interest on $500,000 at 4 per cent	20,000.00		
		$103,225.00	
Total for plant and first year's expenses		202,725.00	

Operating expenses, second year

Salaries	$30,000.00		
Labor	50,000.00		
130,000 seed nuts	3,250.00		
1,100,000 abacá suckers	33,000.00		
Miscellaneous supplies	12,500.00		
General maintenance of plant	7,500.00		
Fence construction	2,500.00		
Depreciation of stock and renewal of small items	7,500.00		
Interest on $500,000	20,000.00		
		$166,250.00	
Total expenses to end of second year			$368,975.00

Operating expenses, third year

Salaries	$35,000.00		
Labor	37,500.00		
130,000 seed coconuts	3,250.00		
Miscellaneous supplies	10,000.00		
General maintenance	10,000.00		
Fence construction	2,500.00		
Additional buildings including laborers' cottages, etc.	5,000.00		
Depreciation of stock and renewal of small items	7,500.00		
Interest on $500,000	20,000.00		
		$130,750.00	

INCOME

110 tons of abacá, at $200	22,000.00		
Pigs	7,500.00		
		29,500.00	
			$101,250.00
Total expenditures to end of third year			470,225.00

Operating expenses, fourth year

Salaries	$37,500.00		
Labor	37,500.00		
130,000 seed coconuts	3,250.00		
4 artificial dryers for copra, at $5,000	20,000.00		
Miscellaneous supplies	7,500.00		
General maintenance	7,500.00		
Fence construction	1,500.00		
Depreciation	7,500.00		
Interest on $500,000	20,000.00		
		$142,250.00	
INCOME			
220 tons abacá (from 480 acres)	44,000.00		
550 tons abacá (from 2,400 acres)	110,000.00		
Pigs	10,000.00		
		164,000.00	
Net gain during fourth year			$21,750.00
Total expenditures to end of fourth year			448,475.00

Operating expenses, fifth year

Salaries	$37,500.00		
Labor	37,500.00		
Miscellaneous supplies	7,500.00		
General maintenance	7,500.00		
Depreciation	7,500.00		
Interest	20,000.00		
		$117,500.00	
INCOME			
1,320 tons abacá (full crop)	264,000.00		
Pigs	12,500.00		
625,000 coconuts from grove "A" (first 1,200 acres, 62,500 trees, 10 nuts per tree)	12,500.00		
		289,000.00	
Credit balance for fifth year			$171,500.00
Total net expenditures to end of fifth year			276,975.00

Operating expenses, sixth year

Salaries	$40,000.00		
Labor	37,500.00		
Supplies	10,000.00		
Maintenance	10,000.00		
Depreciation	10,000.00		
Additional buildings and laborers' cottages	10,000.00		
Interest	20,000.00		
		$137,500.00	
INCOME			
1,320 tons abacá	264,000.00		
Pigs	12,500.00		
2,500,000 coconuts from grove "A" (first 1,200 acres, 62,500 trees, 40 nuts per tree)	50,000.00		
1,250,000 coconuts from grove "B" (first 2,400 acres, 125,000 trees, 10 nuts per tree)	25,000.00		
		351,500.00	
Credit balance for sixth year			$214,000.00
Total debit balance at end of sixth year			62,975.00

Operating expenses, seventh year

Salaries	$40,000.00		
Labor	37,500.00		
Supplies	10,000.00		
Maintenance	10,000.00		
Depreciation	10,000.00		
Narrow-gauge car tracks and rolling stock	12,500.00		
Interest on $500,000	20,000.00		
		$140,000.00	

INCOME

1,320 tons of abacá	264,000.00		
Pigs	12,500.00		
3,750.000 nuts from grove "A" (62,500 trees, 60 nuts per tree)	75,000.00		
5,000,000 nuts from grove "B" (125,000 trees, 40 nuts per tree)	100,000.00		
1,250,000 nuts from grove "C" (125,000 trees, 10 nuts per tree)	25,000.00		
		476,500.00	
Net return, seventh year			$336,500.00
Credit balance at end of seventh year			273,525.00
20 per cent dividend			100,000.00
Sinking fund			173,525.00

Operating expenses, eighth year

Salaries	$42,500.00		
Labor	40,000.00		
Extension of drying plants	20,000.00		
Supplies	12,500.00		
Maintenance	12,500.00		
Depreciation	10,000.00		
Interest	20,000.00		
		$157,500.00	

INCOME

1,320 tons of abacá	264,000.00		
5,000,000 coconuts from grove "A" (62,500 trees, 80 nuts per tree)	100,000.00		
7,500,000 coconuts from grove "B" (125,000 trees, 60 nuts per tree)	150,000.00		
5,000,000 coconuts from grove "C" (125,000 trees, 40 nuts per tree)	100,000.00		
1,250,000 coconuts from grove "D" (125,000 trees, 10 nuts per tree)	25,000.00		
Interest on sinking fund	6,941.00		
		645,941.00	
			$488,441.00
Credit balance for eighth year			661,966.00
Repayment of principal			500,000.00
			161,966.00
20 per cent dividend			100,000.00
Sinking fund			61,966.00

Operating expenses, ninth year

Salaries	$42,500.00		
Labor	40,000.00		
Supplies	12,500.00		
Maintenance	12,500.00		
Depreciation	10,000.00		
		$117,500.00	
INCOME			
1,320 tons of abacá	264,000.00		
6,250,000 nuts from grove "A" (100 nuts per tree)	125,000.00		
10,000,000 nuts from grove "B" (80 nuts per tree)	200,000.00		
7,500,000 nuts from grove "C" (60 nuts per tree)	150,000.00		
5,000,000 nuts from grove "D" (40 nuts per tree)	100,000.00		
Interest on $61,966	2,478.50		
		841,478.50	
			$723,978.50
Credit balance at end of ninth year			785,944.50
60 per cent dividend			300,000.00
Sinking fund			485,944.50

Operating expenses, tenth year

Salaries	$45,000.00		
Labor	40,000.00		
Supplies	12,500.00		
Maintenance	15,000.00		
Depreciation	10,000.00		
4 new drying plants	100,000.00		
2 copra steamers	150,000.00		
		$372,500.00	
INCOME			
990 tons abacá (¾ full crop)	198,000.00		
6,250,000 nuts from grove "A" (100 nuts per tree)	125,000.00		
12,500,000 nuts from grove "B" (100 nuts per tree)	250,000.00		
10,000,000 nuts from grove "C" (80 nuts per tree)	200,000.00		
7,500,000 nuts from grove "D" (60 nuts per tree)	150,000.00		
Interest on $485,944.50	19,437.50		
		942,437.50	
		372,500.00	
			$569,937.50
			1,055,882.00
150 per cent dividend			750,000.00
Sinking fund			305,882.00

Operating expenses, eleventh year

Salaries	$50,000.00	
Labor	45,000.00	
Supplies	17,500.00	
Maintenance	15,000.00	
Depreciation	20,000.00	
		$147,500.00

INCOME

990 tons abacá (¾ crop)	$198,000.00		
31,250,000 nuts from 312,500 trees	625,000.00		
10,000,000 nuts from grove "D" (80 nuts per tree)	200,000.00		
Interest on $305,882	12,235.00		
		$1,035,235.00	
			$887,735.00
			1,193,617.00
200 per cent dividend			1,000,000.00
Sinking fund			193,617.00

Operating expenses, twelfth year

Salaries	$60,000.00		
Labor	45,000.00		
Supplies	25,000.00		
Maintenance	20,000.00		
Depreciation	25,000.00		
		$175,000.00	

INCOME

43,750,000 nuts (from 437,500 trees)	875,000.00		
990 tons abacá (¾ crop)	198,000.00		
Interest on $193,617	7,744.50		
		1,080,744.50	
		175,000.00	
			$905,744.50
			1,099,361.50
200 per cent dividend			1,000,000.00
Sinking fund			99,361.50

"The preceding figures are based upon the assumption that the land to be brought under cultivation is moderately forested and so located that transportation facilities are fairly favorable. Expenses for clearing will of necessity vary considerably according to the nature of the land; for instance, the expenses of clearing 4,800 acres in the second year may cost more than the $50,000 estimated, or in fact on heavily forested ground it *might* be necessary to double this amount. On the other hand, it is expected, as a matter of course, that the most suitable land of the entire area would be selected for the scene of operations in the busy second year, and all economy in the way of plowing and treatment of interspaces would be given the best attention; in other words, to save expenditures which could be carried over in part, at least, into the third and fourth years' expenses, the coconuts transplanted in the 2,400 acres to be planted in this crop, will be given only a reasonable amount of care, merely a fair amount of space around each tree being kept in good condition of tilth. During the third and fourth years the interspaces in the first fields are gradually reduced to the state which permits the cultivation of corn as a catch crop.

"By the same token, it is not necessary and is not considered good economy to bring into the 'fallow' condition more than a moderate proportion of the area cleared during the first and second years. Both abacá and coconuts succeed splendidly on ground that is newly 'brought in,' provided a small area immediately about the young plants is kept friable and free from weeds and grass; thus the plowing expense item can be kept down to a very low figure.

"Corn planting should proceed gradually, as a coconut catch crop; it would quite likely be advisable to plant one or two crops of corn in the abacá plantation; any surplus grain not needed for the pig stock will find a ready local market.

"Should large areas of more or less level ground free from heavy stumps be encountered, it *might* be well to purchase one or two sets of the cable-system steam plows; this would mean an extra expenditure during the first or second years, presumably, of about $20,000 for each set.

"The office building can be furnished at once with modern office fixtures including an (expensive) safe, and imported equipment, or these expenditures can be arranged for gradually as the business increases.

"If it should be found necessary to use a small locomotive on narrow-gauge tracks for hauling nuts to and copra from the dryers and for other similar transportation services an extra $25,000 to $50,000 might be required.

"Theoretically, an oil plant should be established in conjunction with a plantation of this magnitude; the estate would then become a *coconut-oil* instead of a copra central. The expense in drying the 'meat' would be obviated by turning the nuts directly into oil. The operation of the oil plant would call for a very heavy expenditure (perhaps $500,000 or more) for oil containers for long distance shipment; by the same token, this plant might or might not, according to local conditions, avoid the necessity of purchasing the freight steamers to handle the more bulky copra.

"If the topography is very uneven more expense may be entailed in the fencing and road-making operations, the construction of buildings, etc. It might be well to add, even in the first year, several subsidiary commissary depots; once constructed, however, these should be self-supporting, the receipts always going back into supplies, and the low profits amply covering all operating expenses and permitting a moderate increase of stock.

"Under some circumstances the corn-pig system may be impracticable. For quick and good returns, however, abacá will be found, in nearly every case, to be an indispensable secondary crop.

"Briefly speaking, the labor expenditures, at least for the first two years, may be increased, if conditions are *not* moderately good, by 50 to 100 per cent. Expenditures for machinery, buildings, etc., may also be increased during the first three years, through more or less adverse conditions, by 25 to 50 per cent.

"On the other hand, however, it is believed the income from both coconuts and abacá is put well below the normal outturn of an estate of this size managed according to the approved methods of modern agronomy. The present price of coconuts is (according to the locality) 10 to 20 per cent higher than the rate allowed in these figures.

"The abacá receipts will fall to about one-half full crop in the thirteenth, fourteenth, and fifteenth years. At about the fifteenth year the 2,880 acres of abacá should be grubbed up and planted in coconuts.

"Speaking of the *average conditions* in India, Simmonds[1] states:

"'Spathes or shoots, from which eventually the flowers are to appear, will begin to make their appearance in the sixth year, but some kinds of coco palm, as the Nicobar, even before this. * * * The produce of the tree in full health and properly tended is much dependent on soil and climate. The average may be put down at 120 nuts in the twelve months, while in a low and sandy soil it will amount to 200.'

"Although many trees in the well-kept grove will yield 200 nuts, and some even 300 (the record being, it is believed, about 470), it would not be safe to count upon more than 125 to 150 per tree *on the average* 'year in and year out.'

"The trees are in their prime at the twentieth to the fortieth years and keep up without much change to about the sixtieth or eightieth year, i. e., the annual dividend will be from 150 to 250 per cent till about the one hundredth year.

"It is therefore obvious that coconuts are not only the safest but probably the most profitable tropical crop in the world.

"The following tables from 'Coconut Growing in the Philippine Islands,' by the Honorable Dean C. Worcester, formerly Secretary of the Interior, Government of the Philippine Islands, will supply figures for establishing a small plantation:

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[1] Simmonds, Tropical Agriculture.

“ ‘ESTIMATED COST OF ESTABLISHING A 2,500-ACRE COCONUT PLANTATION ON RENTED PUBLIC LAND

“ ‘The following is a statement of the approximate cost of establishing a 2,500-acre coconut plantation and of the revenues which should be derived therefrom at practically the existing market price of copra. It should be remembered, however, that properly dried copra will unquestionably bring a price materially in advance of that commanded by the smoked and imperfectly dried article which at present makes up the bulk of the Philippine product.

“ ‘This estimate is based on clearing half of the land the first year and half the second year. Two hundred acres of land are reserved for buildings and other purposes. A more liberal allowance is made for the cost of clearing the land and preparing it for planting than is called for by the estimates hereinbefore quoted and as the returns from catch crops will manifestly depend directly on the character of the soil selected and on the efficiency of the administration of the estate, no allowance is made for them.

“ ‘Practical experience has shown that under capable administration, with favorable soil and market conditions, they may be made to pay the cost of clearing and planting the land and that of keeping it clean during the first two or three years after it is cleared. I am of the opinion that if this is done it is all that can be expected and I doubt somewhat whether it would be feasible to achieve this result on a coral island. Nevertheless, if I myself were selecting a site for a coconut plantation, I should select one on a coral island which was pretty well isolated in order to avoid possible danger of insects and other pests which might result from the fact the neighboring plantations, if any existed, were badly cared for.

FIRST YEAR

	On ordinary forest land.	On a coral island.
Survey	$250.00	$75.00
Rental	256.00	256.00
Clearing and plowing 1,250 acres, at $20 per acre	25,000.00	----------
Clearing 1,250 acres, at $10 per acre (plowing not necessary)	----------	12,500.00
Cost of seed	1,656.25	1,656.25
Planting 33,000 nuts, at $0.02½ each	825.00	825.00
Fencing	1,000.00	----------

FIRST YEAR—Continued

	On ordinary forest land.	On a coral island.
Assistant manager's salary	$1,800.00	$1,800.00
Assistant manager's house	1,000.00	1,000.00
Laborers' quarters	2,000.00	2,000.00
Storehouse for rice, tools, trade goods, etc	500.00	500.00
Well, tank, pumping engine, and pipe for water supply	600.00	600.00
1 mile of track (rail, 12 pounds to yard)	765.00	765.00
5 cars, at $30 each	150.00	150.00
Tools	500.00	500.00
15 draft cattle, at $40 per head	600.00	600.00
1 American or Australian horse	150.00	150.00
2 native ponies, at $50 each	100.00	100.00
One 30-foot launch 10-horsepower petroleum engine	1,500.00	1,500.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Total	39,302.25	25,627.25

NOTE.—A launch is estimated for because unless the plantation is located directly on some interisland harbor one will be necessary in keeping up communication between the plantation and the nearest port. A liberal estimate has been made for quarters for men, which would allow of putting up a substantial shed, with galvanized-iron roof. It would give the men good quarters and could later, at small additional expense, be converted into a drying shed, while the iron roof would be useful for catching rain water, especially on coral islands. A good well, with a pump, tank, and pipe, is essential in order to provide adequate bathing facilities for the assistant manager and men, and water for animals, sprouting nuts, etc.

It would probably be necessary to run a small store in connection with a plantation at which articles of common necessity should be sold at Manila prices, plus 20 per cent, plus cost of transportation, but labor should be paid for in cash and the men left free to trade at the store or not, as they please.

From the total should be deducted the receipts from catch crops, if any, and from the sale of timber and firewood, which on forest land might somewhere nearly cover the cost of clearing and planting. The sandy soil of coral islands will grow pineapples, peanuts, cassava, corn or yams, but as weeds do not spring up readily on this soil and as comparatively little work is required to keep it clean, it might be more desirable not to plant catch crops but to leave all plant food in the soil for the coconut trees.

It will be noted that I have provided for an assistant manager only. It would be necessary to have one competent man constantly on the ground. There would be necessity for work in other places in connection with the purchase and shipment of supplies, seed nuts, etc., and the securing of laborers, which should be performed by a manager, and the best way to provide for this unless the owner himself cares to do it would be to have one thoroughly competent man who would serve as general manager for several plantations and who would not only perform the work above referred to but would visit and inspect the plantations at frequent intervals. If the assistant manager proves capable, his salary should be raised $200 per year until it reaches at least $3,000.

SECOND YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Clearing and plowing 1,250 acres, at $20 per acre	25,000.00	
Clearing 1,250 acres, at $10 per acre (plowing not necessary)		12,500.00
Cleaning 1,250 acres of land already planted, at $10 per acre	12,500.00	
Cleaning 1,250 acres of land already planted, at $5 per acre		6,250.00
Planting 33,000 nuts, at $0.02½ each	825.00	825.00
Fencing	1,000.00	
40 laborers' houses, at $25 each	1,000.00	1,000.00
Assistant manager's salary	2,000.00	2,000.00
Tools	400.00	400.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	451.50	451.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	44,582.50	24,832.50

NOTE.—From the totals above given should be deducted the receipts from the sale of catch crops and from the sale of timber and firewood, if any.

THIRD YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres of land, at $5 per acre	12,500.00	
Cleaning 2,500 acres of land, at $2.50 per acre		6,250.00
Assistant manager's salary	2,200.00	2,200.00
Tools	250.00	250.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	451.50	451.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	16,807.50	10,557.50

NOTE.—From the total should be deducted the value of catch crops, which on forest land should be sufficient to pay the cost of keeping the land clean.

FOURTH YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres, at $5 per acre	12,500.00	
Cleaning 2,500 acres, at $2.50 per acre		6,250.00
Assistant manager's salary	2,400.00	2,400.00
Tools	200.00	200.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	451.50	451.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	16,957.50	10,707.50

NOTE.—From this year on there will be no catch crops of importance.

FIFTH YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres, at $5 per acre	12,500.00	
Cleaning 2,500 acres, at $2.50 per acre		6,250.00
Assistant manager's salary	2,800.00	2,800.00
Tools	200.00	200.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
4 miles of track	3,100.00	3,100.00
½ mile of portable track	1,380.00	1,380.00
10 cars, at $30 each	300.00	300.00
Depreciation on buildings, 1 mile of track, and water system (10 per cent)	451.50	451.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	21,937.50	15,687.50

NOTE.—On favorable land some nuts will be harvested during the fifth year.

SIXTH YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres, at $5 per acre	12,500.00	
Cleaning 2,500 acres, at $2.50 per acre		6,250.00
Assistant manager's salary	2,800.00	2,800.00
Tools	200.00	200.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	929.50	929.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	17,835.50	11,585.50

NOTE.—The sixth year a half crop of 30 nuts per tree may be estimated. While all the land in the plantation will need to be cleared in the first instance and kept clean thereafter, it will be safe to allow 200 acres for waste land and for that used for buildings, etc., so the crop of nuts for the sixth year from 1,150 acres may be estimated at 1,380,000, which should give 6,900 piculs of copra, worth $34,500, less cost of harvesting nuts and making copra.

SEVENTH YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres, at $5 per acre	12,500.00	
Cleaning 2,500 acres, at $2.50 per acre		6,250.00
Assistant manager's salary	3,000.00	3,000.00
Tools	200.00	200.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	929.50	929.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	18,035.50	11,785.50

NOTE.—This year a full crop of 2,750,000 nuts may be estimated for 1,150 acres and a half crop of 1,380,000 nuts for the remaining 1,150 acres under cultivation, or 4,130,000 nuts in all, from which 20,700 piculs of copra should be obtained, worth $103,500.

EIGHTH YEAR

	On ordinary forest land.	On a coral island.
Rental	$256.00	$256.00
Cleaning 2,500 acres, at $5 per acre	12,500.00	
Cleaning 2,500 acres, at $2.50 per acre		6,250.00
Assistant manager's salary	3,000.00	3,000.00
Tools	200.00	200.00
5 draft cattle, at $40 per head	200.00	200.00
Launch engineer, at $37.50 per month	450.00	450.00
Kerosene, engine oil, cotton waste, for launch	200.00	200.00
Depreciation on buildings, track, and water system (10 per cent)	929.50	929.50
Depreciation on launch (20 per cent)	300.00	300.00
Total	18,035.50	11,785.50

NOTE.—During this year and thereafter a full crop of nuts should be harvested from the entire 2,300 acres, amounting to 5,520,000 nuts, equivalent to 27,600 piculs of copra, worth $138,000.

"Mr. J. Shaw Hellier, a planter who has had much experience in Burma and the Malay States has submitted the following figures for establishing a 2,500-acre coconut plantation on an island in the Philippines:

Expenditure first year

Preliminary expenses	$5,000
Survey	100
Rental	256
Clearing 1,000 acres, at $10 an acre	10,000
Seed nuts	1,500
Lining, holing, planting	1,500
Upkeep	5,000
Nurseries	500
Salaries	6,000
Manager's bungalow	1,000
Assistant's bungalow	500
Furniture for 2 bungalows	600
Coolie lines	2,000
Store	500
Water supply	600
Tools	500
Horses	250
Cattle	600
Recruiting	500
Launch	1,500
Upkeep of launch	700
Landing stage	500
Stationery, office	500
Medicines	500
Contingencies	1,000
Total	41,606

Expenditure second year

Rental	$256
Cleaning 1,000 acres	10,000
Upkeep of 2,000 acres	10,000
Seed nuts	1,500
Lining, holing, planting 1,000 acres	1,500
Salaries	7,000
Coolie lines	500
Recruiting	250
Nurseries	500
Tools	500
Cattle	200
Upkeep, buildings	200
Upkeep, launch	700
Stationery	100
Medicines	200
Water supply	500
Doctor	1,000
Contingencies	1,000
Total	35,906

Expenditure third year

Rental	$256
Cleaning 500 acres	5,000
Upkeep 2,500 acres, at $5 an acre	12,500
Seed nuts	750
Lining, holing, and planting	750
Salaries	8,000
Coolie lines	250
Recruiting	125
Tools	500
Cattle	200
Upkeep, buildings	400
Upkeep, launch	800
Nurseries	250
Sationery	200
Doctor	1,000
Medicines	300
Contingencies	1,000
Total	32,281

Expenditure fourth year

Rental	$256
Upkeep 2,500 acres, at $4 an acre	10,000
Salaries	9,000
Recruiting	125
Tools	300
Cattle	200
Upkeep, buildings	400
Upkeep, launch	800
Stationery	200
Doctor	1,000
Medicines	300
Contingencies	1,000
Total	23,581

Expenditure fifth year

Rental	$256
Upkeep 2,500 acres, at $3 an acre	7,500
Gathering, curing crop	3,000
Salaries	10,000
Recruiting	125
Tools	300
Cattle	200
Upkeep, buildings	400
Upkeep, launch	800
Stationery	200
Doctor	1,000
Medicines	350
Curing house with machinery	10,000
Contingencies	1,000
Total	35,331

Expenditure first year	41,606
Expenditure second year	35,906
Expenditure third year	32,281
Expenditure fourth year	23,581
Expenditure fifth year	35,331
Total	168,705

$168,705 equals $67.50 per acre.

Hereafter expenditure may be put at $25,000 per annum.

Revenue sixth year

1,000 acres at 20 nuts per palm	$800,000
1,000 acres at 10 nuts per palm	400,000
Total	1,200,000

1,200,000 nuts equal 5,454 piculs copra, at $5 per picul, $27,270.

Net income, $2,270.

Revenue seventh year

1,000 acres at 35 nuts per palm	$1,400,000
1,000 acres at 20 nuts per palm	800,000
500 acres at 10 nuts per palm	200,000
Total	2,400,000

2,400,000 nuts equal 10,909 piculs copra, at $5 per picul, $54,545.

Net income, $29,545.

Interest, 45 per cent.

Revenue eighth year

1,000 acres at 50 nuts per palm	$2,000,000
1,000 acres at 35 nuts per palm	1,400,000
500 acres at 20 nuts per palm	400,000
Total	3,800,000

3,800,000 nuts equal 17,272 piculs copra at $5 per picul, $86,360.

Net income, $61,360.

Interest, 57 per cent.

Revenue ninth year

1,000 acres at 60 nuts per palm	$2,400,000
1,000 acres at 50 nuts per palm	2,000,000
500 acres at 35 nuts per palm	700,000
Total	5,100,000

5,100,000 nuts equal 23,181 piculs of copra at $5 per picul, $115,905.

Net income, $90,905.

Interest, 64 per cent.

Revenue tenth year

2,000 acres at 60 nuts per palm	$4,800,000
500 acres at 50 nuts per palm	1,000,000
Total	5,800,000

5,800,000 nuts equal 26,363 piculs of copra at $5 per picul, $131,815.

Net income, $106,815.

Interest, 75 per cent.

Afterwards the crop should be about 6,000,000 nuts annually—27,272 piculs of copra, at $5 per picul, $136,360. Giving a net income per annum of $111,360.

Dividend, 87 per cent.

NOTES ON THE ABOVE ESTIMATE

" 'In my opinion an island or peninsula is eminently suitable for coconut growing; either usually contains the essential condition as to soil, water, etc. Besides which they often offer the following special attractions:

" '(1) Light clearing.

" '(2) Small upkeep. The land not growing rank vegetation.

" '(3) Fencing small amount or none.

" '(4) Drainage little or none on account of the nature of the soil and the lay of the land.

" '(5) Little or no roading, the soil being sandy would allow of wagons being drawn over it at all seasons and the nuts might largely be collected by water.

" '(6) Probable exemption from disease, animals or thieves.

" 'Against these advantages one must put the following:

" '(1) Purchase and upkeep of launch, boats, etc.

" '(2) Extra expenses in obtaining good fresh water.

" '(3) Possible extra cost of labor and things on account of isolation.

" 'There are many advantages in running a proposition of this sort on a large scale. If, say, 6 blocks of 2,500 acres were taken up adjoining each other, this would allow of an oil mill being put up to good advantage. Large savings can be effected by the management. It allows of a thoroughly experienced planter being engaged as general manager, which is absolutely essential.

" 'In these estimates I have reckoned on 40 palms to the acre, planting 30 by 30 will give 48. I have taken 220 nuts as making a picul of copra.'

"It will be noticed that in the above estimate Mr. Shaw Hellier allows for more than twice as many seed nuts as does Mr. Worcester—150,000 against 66,000; the former runs his rows about 9 by 9 meters (30 by 30 feet) while if the latter provides only 66,000 nuts for the 2,300 acres the rows would have to be about 12.2 by 12.2 meters (40 by 40 feet). In other words Mr. Shaw Hellier allows for 48 palms per acre against Mr. Worcester's 27—an increase of 77 per cent. In the writer's opinion the planter may take 120 trees per hectare (50 per acre) as the regulation number, though if he does not make a rather strong point of secondary crops in the young groves he may put as high as 65 or 70 trees per acre without crowding them for the first twenty-five years. If the planter finds that this quotum per acre is a little too much, the light-crop trees may be thinned out just as individual rubber and fruit trees are tapped to death or weeded out to make room for the more prolific individuals. In passing, we must recognize the fact that there are many groves in the Philippines with a stand of fully 500 trees per hectare (200 per acre) and we are forced to admit that at even *ten nuts per tree* on an average, the total may be in excess of that from a well spaced plantation yielding 80 to 100 nuts per tree; against the modern planter's protest of bad principle and short life of the old-style grove, the Filipino planter can offer the irrefutable argument of little or no cost of upkeep and a comfortable income.

"While nearly every seed nut, if well selected, will give a tree worth planting, the wise superintendent will plant only *vigorous* seedlings; he will likewise have on hand a moderate quantity (say, 10 per cent) of stock in the nursery for 'supplies' in case of the death of some of the plants at the time of transplanting; in other words, he will allow about 120 seed nuts for every 100 propective palms in the grove.

"Mr. Shaw Hellier allows for 220 nuts per picul[1] of copra, while Mr. Worcester allows for only 200. Both these estimate are too low, at least for nuts from the young trees; unless the trees are in an unusually vigorous condition and well spaced, the planter will do well to allow for 275 to 325 nuts per picul of well-dried copra; after long droughts as many as 500 and even more are required. Samoa and German East Africa reckon 7,000 nuts to the ton, or well over 400 to the picul; 6,000 is probably about the average for the world."—(Bulletin No. 25, "The Philippine Coconut Industry," by O. W. Barrett, formerly chief, division of horticulture, Bureau of Agriculture, Philippine Islands.)

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[1] A Philippine picul of copra weighs 139 pounds. About 16 piculs make 1 long ton.

Further information on this subject may be obtained from the director-general of the Philippine Exposition Board, Panama-Pacific Exposition, or by application to the Director of Agriculture, Manila, P. I.

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VEGETABLE AND ESSENTIAL OILS

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VEGETABLE AND ESSENTIAL OILS

VEGETABLE OILS

PLANTS with oil-bearing seeds are widely distributed. Of those growing in warmer climates the coconut is probably the most important.

Coconut.—The growing of the coconut as an industry in the Tropics is arousing more interest every year. The Philippines, while now among the leading coconut (copra) producers of the world, are capable of almost indefinite expansion in this regard. The methods of handling and disposing of the product need improvement, however, while the extraction of the oil in the Philippines, rather than exportation of the raw material, should be extended. There is no question but that the coconut industry in the Philippines offers one of the most attractive fields for capital now available.

The amount of copra exported during the past ten years is as follows:

Copra exported from the Philippine Islands

[Values in U. S. currency.]

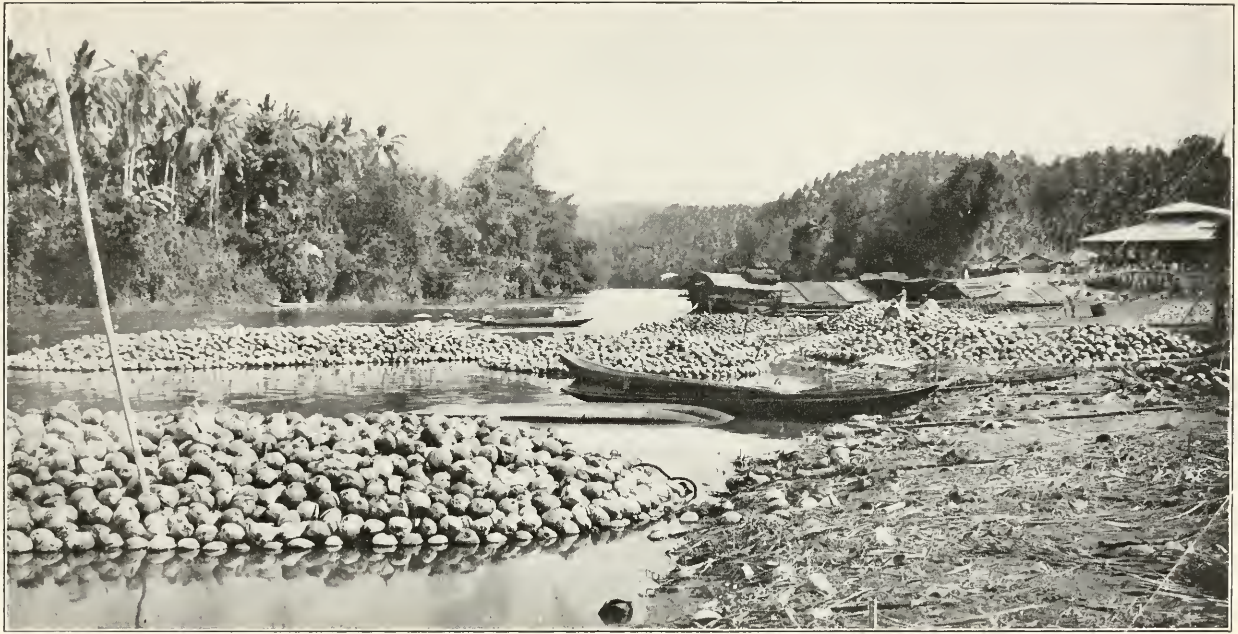
Fiscal year.	Quantity.	Value.	Average value per ton.	Percentage of total export.
	Met. tons.	*Dollars.*	*Dollars.*	
1904	54, 133	2, 527, 019	46. 68	7. 0
1905	37, 557	2, 095, 352	55. 79	5. 6
1906	66, 158	4, 043, 115	61. 11	12. 3
1907	49, 082	4, 053, 193	82. 58	11. 8
1908	76, 420	5, 461, 680	71. 47	16. 6
1909	105, 565	6, 657, 740	63. 07	21. 1
1910	115, 285	9, 153, 951	79. 40	22. 9
1911	115, 602	9, 899, 457	85. 63	24. 9
1912	169, 342	16, 514, 749	97. 52	32. 8
1913	113, 055	11, 647, 898	103. 03	21. 9

During the last three months of the fiscal year 1913 there were exported 1,302,275 kilograms of coconut oil valued at $312,513. This represents the oil from approximately 2,200 metric tons of copra. This raw copra, at $103.03 per metric ton, would have been worth $226,666, so that the manufacturers received more than $85,000 for the cost of production and profits, while the press cake could be disposed of at a fair price. Coconut oil has an extended use as an edible oil, in the manufacture of soap, etc.

Castor oil.—The castor-oil plant grows readily in all parts of the Philippine Archipelago, occurring as a weed in waste places. At present there is no attempt to make use of it commercially. However, when one considers the many uses for castor oil, the cultivation of the plant suggests great industrial possibilities.

The plant grows luxuriantly and produces abundantly under natural conditions. Any initial outlay in milling machinery would be unnecessary, as the product can be worked up in a coconut-oil mill. We are nearer to the Australian market than is British India, from whence the Australian supply of castor oil is brought. The development of the industry here could supply that market, as well as the increasing demands of America.

Lumbang bato and lumbang banucalag nuts.—Both lumbang bato and lumbang banucalag belong to the genus *Aleurites*, as does the wood or tung oil nut of China. The nut known locally as lumbang bato is identical with the kukui nut of the Hawaiian Islands, and is known generally as the candle nut. The lumbang banucalag nut is very similar to the candle nut, but possesses a softer shell and would be easier to work. They both yield drying oils of fine quality, superior to linseed oil in rate of drying. The trees which produce these nuts are well distributed over the Islands, and their cultivation should



Rafts of coconuts.

become a profitable industry, as they grow quickly, bear early, and have no known enemies.

The lumbang bato nut yields from 60 to 65 per cent, based on the kernel, of a light-yellow oil when extracted with a solvent. Lumbang banucalag yields somewhat less than 60 per cent under the same conditions. Neither has the peculiar odor characteristic of tung oil on drying. At present practically all the oil used is prepared and marketed in Manila. There are only a few places where oil is being expressed, and the presses used are of the crudest description. This oil sells at 50 cents per gallon.

Palo maria nut.—Palo maria nut oil, improperly called laurel nut oil in Indo-English, grows native in the Philippine Islands. It cannot be used as an edible oil owing to a poisonous resin contained in it. It is sold in Europe under the name of "udiloöl" as a remedy for rheumatism and skin diseases. At present it sells for several times the price of castor oil in Burma. The kernels on extraction yield from 70 to 75 per cent of a greenish yellow oil.

Kapok seed.—The cotton tree, which furnishes the fiber used commercially for upholstering, under the Malayan name "kapok," is exceedingly common in all parts of the Philippines. The fruit is a spindle-shaped pod from 4 to 5 inches long. It is filled with black seeds embedded in fine silky hairs. In Java the seed hairs are used for stuffing mattresses, sofas, and similar articles. In Manila they are being used with excellent results for insulation. The ground seeds extracted with petroleum ether yield 25 per cent of a bland edible oil.

Cashew nut.—The cashew nut tree grows readily throughout the Archipelago. It was introduced here from tropical America. The nut is a large pear-shaped fruit, and contains a brown, kidney-shaped seed attached to one end of the fleshy part. Both the fruit and nut are edible, the latter, when roasted, having a very agreeable taste. The expressed kernel yields a sweet, yellowish edible oil.

Physic nut.—The physic nut was introduced from Mexico. It yields from 30 to 40 per cent of a yellowish oil with a faint, peculiar odor and a bland, nutty taste. It belongs to the semidrying oils, and is employed in the manufacture of soaps and candles; it also has some use as a lubricant and as a medicine. The plant is very abundant in the settled areas of the Philippines.

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ESSENTIAL OILS

Tropical or semitropical countries are the natural homes of the essential oil producing plants. Among these countries the Philippine Islands occupy a high position. This rank bids fair to greatly increase with the development of the present known plants, the discovery of new species native to the Islands, and the introduction of those already well known elsewhere.

Ylang-ylang.

Ylang-ylang.—Ylang-ylang is undoubtedly the best-known essential oil produced in the Philippines. This oil has a large sale in Germany and France as perfumery stock. The Philippine product and that from Réunion are considered standard by buyers. The quantity and value of ylang-ylang oil exported from the Philippine Islands during the last five years is as follows:

Ylang-ylang oil exported from the Philippine Islands

Year.	Amount.	Total value.
	Kilos.	*Dollars.*
1909	2,812	87,936
1910	1,878	58,334
1911	1,684	47,404
1912	2,785	80,879
1913	2,172	58,309

With the more general introduction of improved methods of collecting flowers, and installation of modern machinery for the extraction of the oil, a large increase in the foreign sales may be expected.

Champaca.—The champaca flower is considered by experts to produce the finest perfume of any of the flowers of the Philippines. This flower contains approximately 0.2 per cent of oil, while the ylang-ylang flowers yield from two to three times this amount, but the champaca oil sells at a much higher price. As the trees begin bearing flowers while young, and the market for the oil is active, the extraction of champaca oil promises to become an important industry.

Ginger.—The ginger plant is cultivated to a limited extent in all parts of the Islands and yields a good supply of oil.

Calomata.—The leaves of *Glausena anisum-olens* (Blanco) Merr., which is rather abundant in some parts of the Philippines, yield an oil having an odor of anise. It is used locally as a flavor for beverages. Schimmel & Co.'s Semiannual Report, 1914, states that the supply of anise oil stock is very unsatisfactory. This would warrant hopes for the introduction on the market of a good substitute.

Lemon grass.—Lemon grass oil as a source of citral can be produced profitably here, owing to the cheapness of labor. It has been calculated that 1 acre of land would give an annual yield of 25 pounds. Due partially to the expiration of the ionone patents, the price of lemon grass oil has advanced. The annual production of this oil now exceeds a quarter of a million pounds. The Philippines have no part in this, though they are by nature well adapted to produce lemon grass oil profitably.

Champaca.

Cinnamon.—With regard to cinnamon, Schimmel & Co.'s Semiannual Report, 1914, states: "The prices of the raw material have remained firm and the demand increased to such an extent in the course of the winter, that our factory was at times unable to keep pace with it;" and again, "The situation of the article is such that lower prices are not to be expected in the near future." The cinnamon tree occurs in the Davao district of Mindanao, and offers a good opportunity for development.

Vetiver.—Vetiver oil is obtained from *Andropogonzizanioides* Urb. (*A. squarrosus* L. f.) a grass which is found abundantly in all parts of the Archipelago. As this oil sells at from $50 to $100 per kilogram (2.2 pounds) in Europe, the distillation of the native plant would be profitable. The exportation of the dried roots to Europe also offers possibilities.

Citrus.—At present the orange, lime, and pomelo are all sold in the local market for home consumption, but this industry could be increased to such an extent that these fruits would be available for bottling purposes and for the preparation of oil. The oil corresponds favorably in quantity and quality with other citrus oils obtainable in other parts of the world. There are distinct possibilities in the distillation of the oil from the leaves of some forms.

Blumea balsamifera DC.—*Blumea balsamifera* grows abundantly in all parts of the Islands. It yields from 0.1 to 0.4 per cent of yellow oil with a camphorlike odor, consisting of almost pure 1-borneol. As 1-borneol can be oxidixed very readily to camphor, the oil should have a commercial value. The growth of the plant is exceedingly vigorous, and the leaves could be cut four times a year.

Balao resin.—Balao resin coming from a tree of the Islands is chiefly used at present in the varnishing and caulking of native boats. It gives a very brilliant, tough, and durable coat, but has the disadvantage of drying somewhat slowly. As this resin does not belong to the fossil resins, the supply would be permanent.

Manila elemi.—Manila elemi flows from the bark of *Canarium luzonicum* chiefly at the time when new leaves are coming out. The Filipinos hack the tree with a bolo to cause the flow. Healthy mature trees will average from 8 to 11 pounds of resin per year, although large trees will sometimes yield much more. The total world production is not large, and as the greater part comes from the Philippines it is known as Manila elemi. It is used medicinally in the preparation of ointments and plasters, and has a somewhat limited use at present in the manufacture of lacs and varnishes for imparting toughness. Recently it has come into use in the preparation of lithographic inks.

Pitch seed.—Pitch seed is the product of *Pittosporum,* several species of which occur in the Philippine Islands. Even when green the fruits burn very readily. They are interesting scientifically, because they contain considerable quantities of normal heptane. This paraffin oil occurs also in the digger pine of California, the only other instance known.

Cassie.—Cassie is a spiny shrub (*Acacia farnesiana*) with heads of fragrant yellow flowers; it is very abundant in many parts of the Philippine Islands. This plant is extensively utilized in southern France, but is not utilized at present in the Philippine Islands.

OTHER POSSIBLE SOURCES OF ESSENTIAL OILS

The plants named below are very promising when considered from the standpoint of essential oils: *Gardenia, Clausena,* "dama de noche" (*Cestrum*), "camia" (*Hedychium*), *Ocimum, Coleus amboinicus, Limnophila manilensis, Piper* spp., *Cleome viscosa, Mallotus floribundus,* papaya (flowers), *Lawsonia inermis, Aglia odorata, Quisqualis indica, Jasminum sambac, Plumeria alba,* and other species.

The Islands are thus seen to have a promising future from the standpoint of essential oil bearing plants both on account of favorable climatic conditions, and because of a plentiful labor supply.

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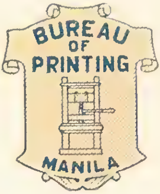
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FOREST RESOURCES OF THE PHILIPPINES

TIMBER

Area.—The virgin forests of the Philippine Islands cover approximately 40,000 square miles, about equal to the area of the State of Kentucky. This is about one-third of the total area of the Archipelago. In addition there are estimated to be about 20,000 square miles of second-growth forest which will yield large quantities of firewood and some small-sized timber. Taken together, the virgin and second-growth forests of the Philippines cover an area about equal to that of the State of New Mexico.

Ownership.—More than 99 per cent of the timber belongs to the Philippine Government and is under the administrative control of the Bureau of Forestry. Less than 1 per cent of the timber is held under sure title of private ownership.

Composition.—About 70 per cent of all Philippine timber belongs to the dipterocarp family, which is generally found in stands which are almost pure from the lumberman's point of view. The largest individuals of this family reach 200 feet in height and some specimens have a diameter of 7 feet. This family is by far the most important, as it furnishes the main bulk of the timber cut in the Philippines. About a dozen botanically distinct species furnish probably 80 per cent of the entire cut. From the standpoint of the lumberman, however, this number can be reduced to three groups, namely, the lauans, apitongs, and yacals.

Yacals.—This group comprises trees locally known as yacal, narig, mangachapuy, and dalingdingan. The timbers are hard and durable and are more plentiful than the other very durable commercial woods of the Islands.

Apitongs.—The apitong group comprises timbers known as apitong, panao, hagachac, and guijo. The first three are marketed under the name of apitong. Guijo is generally considered somewhat superior. Well-seasoned timbers of this group weigh between 40 and 50 pounds per cubic foot.

Lauans.—It is in this group that the main wealth of the Philippine forests lies. It comprises timbers locally known as white lauan, red lauan, almon, balacbacan, bagtican, mayapis, tiaong, and tanguile. For the sake of simplicity, they may be divided into two classes, namely, the white and red lauans. Export grades of the red lauans are used in Europe and America as substitutes for mahogany, and are frequently sold as such. While not so hard and durable as mahogany, lauan has a beautiful grain and permits of a very fine polish.

The main bulk of the forests produces timbers of comparatively few kinds and in some instances approaches pure stands of one or two grades. It is estimated on an average that 70 to 80 per cent of all the dipterocarp forests will yield timbers that belong to the groups described above.

Leguminosae.—Next in importance to the dipterocarp family are the leguminosae, or locust family, to which a number of the commercially important cabinet woods of the Philippines belong. Among the principal representatives of this family are narra, tindalo, ipil, supa, acle, and banuyo. No finer hardwoods are found anywhere in the world.

Stand.—The average stand in the virgin forests of the Philippines may be roughly estimated to run 6,000 board feet per acre and over. On some of the tracts now being worked under long-term license agreements (or concessions as they are popularly called) the stands run between 15,000 and 35,000 board feet per acre. Stands of 45,000 to 60,000 board feet per acre are not infrequent, principally at elevations between 800 and 1,200 above sea level.

Obtaining a tract of timber.—The public forests of the Philippines are not sold, but are developed under a license system. Small operators usually work under ordinary yearly licenses for definite small areas. Exclusive licenses, or concessions as they are popularly called, are generally in the form of a twenty-year exclusive license to cut and extract timber and other forest products from a specified tract. The land itself is in no way affected by such a license, merely the timber and minor forest products are included.

When a lumberman seriously considers an investment in the Philippines he himself or an experienced representative should state to the Director of Forestry approximately the extent of the investment he contemplates. He will then be given information about several tracts which promise to answer his needs, and arrangements can be made for an experienced forester to accompany him over the tracts in question so that he can size up conditions for himself. All maps, estimates, and other detailed information which may have been collected on the tract will, of course, be placed at his disposal, and he can count upon the heartiest governmental coöperation and assistance in making a success of his enterprise. It should be understood, however, that in no case does the Director of Forestry guarantee the correctness of the estimates or other data which he furnishes. These are given to the applicant for what they are worth, and in every case he is advised to take such steps as may be necessary to satisfy himself as to whether or not they are correct. If the lumberman then decides to apply for the concession, he makes a formal application in writing to the Director of Forestry for an exclusive twenty-year privilege for the tract he has selected. His application is then forwarded by the Director of Forestry with recommendations to the Secretary of the Interior. He may then approve the issuance of an exclusive license, if he decides that such a course is in the public interest. For an area of more than 1,000 hectares (approximately 2,500 acres) proposals for bids to secure the desired privilege are published in the Official Gazette and other papers. At least six weeks intervene between the appearance of the first advertisement and the opening of the bids, but in order to give interested parties in the Philippines ample time to correspond with their principals in Europe or America this period is usually extended to about four months. The advertisement states the amount of capital which must be invested within a given time, the minimum cut during the several succeeding years, together with certain requirements regarding logging and milling equipment, etc.

Formal bids are finally submitted and the license will be granted to the bidder who gives the best assurances of developing the tract most thoroughly and promptly. The right to reject any and all bids is expressly reserved. The areas thus granted as concessions are generally of sufficient extent to permit operations for a considerably longer time than the period for which they are granted, and thus the logger and millman in making his investment may expect to operate not merely for twenty years, the limit expressed in his license agreement, but almost for an indefinite period. In fixing the annual production there is taken into consideration so far as possible the amount of overmature timber on the stand and the amount of annual increment, with the object of rendering the investment a permanent one instead of merely permitting the operator to strip and abandon the area he holds. In preparing regulations under which the operator is required to work, first care is given to the future condition of the area in order that the land after logging may be potentially as valuable as before, and no consideration of immediate profit is allowed to interfere. Nevertheless, the logger in the Philippines will find that in comparison with similar conditions elsewhere he will have few restrictions to contend with, and in practically no case are these such as seriously to increase the cost of his operations. It is to permit such permanent use of the land that concessions are granted over such large areas, often consisting of

100 square miles or more. The Philippine Government sells its timber cheap—at half and less than half the stumpage prices asked for similar woods in neighboring tropical countries. It costs nothing to secure a concession—evidence of good faith is all that is required. It may be mentioned that the stumpage is collected as the timber is cut.

Sawmills.—At present there are about 70 sawmills of all sizes and descriptions operating in the Islands, about 12 of which can be compared to the average modern sawmills in the United States. The largest sawmills are located on timber concessions, while the others are operated under short-term licenses. The total cut of the mills of the Philippine Islands is about 65 to 70 million board feet per year.

A company properly equipped and managed and operating in a suitable tract should be able to deliver many kinds of native lumber in Manila at a cost of about half the prevailing market prices. The commercial forests are found either along the coasts where the timber can be skidded directly to the beach and loaded in suitable harbors, along navigable and floatable rivers where it is skidded directly to the water and floated or rafted down stream, or at a short distance inland where short logging railroads are advisable or necessary. For such timber as is close to the beach or large rivers, logging is easy and cheap, requiring but little capital. In these forests there are already a large number of operators, most of whom cut only small quantities of timber. The shipping of timber to the market from isolated sawmills in the Philippines involves considerable difficulty and expense and the lumberman who does not own his own interisland transportation is decidedly handicapped. Few interisland steamers are adapted for carrying lumber and freight rates are high and sometimes prohibitive. A company operating on a large scale should therefore provide its own means of transportation to the Philippine markets or else make provision for loading export stock direct to ocean-going vessels at the mill. With such privately owned interisland transportation the lumber ought to be carried to Manila for from $3.50 to $4.50 United States currency per 1,000 board feet, or even less. Freight rates from Manila to the Pacific coast vary from $7 to $8 United States currency per ton (logs), or from $10 to $14 per 1,000 board feet. There are no export duties on timber or manufactured products. Sawmill and logging machinery from the United States can enter duty free, and timber and logs are admitted to the United States without customs charges. Any mill with a capacity of 1,000,000 feet or more per month of export material is in a position to ship directly to the United States and other countries, thus saving the cost of transportation to Manila and reshipment.

Labor conditions.—The Filipino has a natural aptitude for running machinery and is easily taught. Given a good, experienced foreman it is surprising how well a Filipino crew can handle a sawmill. They work for small wages—from $0.25 to $0.75 United States currency per day for unskilled labor—and if they are accorded fair treatment they make steady and permanent workmen. In the thinly settled forest regions it is necessary to bring in labor from the more thickly settled provinces. To the lumberman the labor problem in the Philippines is not a difficult one. He will find that he has escaped many of the vexatious labor difficulties of the United States to meet comparatively few in the Philippine Islands. Patience and fair dealing will secure most excellent results.

Markets.—Approximately 80 to 100 million board feet of lumber are used each year in the Philippine Islands. Of this, strange to say, a considerable amount is imported, although the amount of such imported lumber is steadily being lessened as the capacity of the Philippine mills increase. China, Japan, and Australia use yearly more than 200 million board feet of American lumber, a large part of which could be furnished by lumber companies in the Philippines if there were a sufficient number properly capitalized and equipped. A market for Philippine lumber has already been secured in the United States and to a lesser extent in Europe. As already stated, many Philippine timbers are unexcelled for interior finish, cabinetwork, and other special uses for which imported woods are coming to be more and more demanded in the United States and Europe as the local supplies of hardwoods diminish.

MINOR FOREST PRODUCTS

This term includes all products of the forest except timber or lumber. Many of the minor forest products of the Philippines are at present almost unknown in the world's markets and are largely confined to local use. They are developed under a system of licenses issued by the Bureau of Forestry very much as in the case of timber. Forest charges amount to 10 per cent of the local market value. Among the minor forest products which are more or less generally used throughout the Islands and which have export possibilities are the following:

Nipa products.—Nipa is a palm that grows on the tidal flats along the seacoast. Nipa areas, or nipales as they are called locally, vary in extent up to about 20,000 acres; although there is one area which is estimated to embrace about 45,000 acres, only one-third of which, however, is being utilized at present. Nipa sap has the important distinction of being the cheapest raw material known in the world for making sugar and alcohol. After extraction from the flower stalk this sap is known as "tuba" and contains about 15 per cent of sugar when fresh. Investigations made by the Philippine Bureau of Science bear the definite conclusions that nipa sugar is equal to cane sugar and can be extracted cheaper, as no crushing machinery is necessary; also that a hectare (2.47 acres) of nipa will produce 10,428 kilos (22,942 pounds) of sugar which, valued at $0.08 United States currency a kilo (2.2 pounds), would yield an annual income of more than $800 United States currency.

The yield of alcohol varies, depending on the grade of the product. It has been found that a hectare of nipa (about 2,000 plants) will average 86,000 liters (21,500 gallons) of sap per year; and that from 16 liters (4 gallons) to 30 liters (7.5 gallons) of sap are required to produce 1 liter of alcohol.

Nipa alcohol was awarded the first prize for purity at the Paris Exposition.

The use of alcohol of 186 proof, mixed with 10 per cent gasoline, has been shown to be of equal effectiveness with pure gasoline in a year's continuous trial in six automobiles in Manila. Manila imports about $200,000 worth of gasoline each year which could apparently be supplanted by alcohol.

On account of the opportunity for their utilization on a commercial scale, the products of the nipa palm must therefore be ranked among the most important minor forest products of the Philippines. All nipa growing on public land is under the supervision of the Bureau of Forestry; and up to the present time no forest charges on its products have been assessed.

Rattan.—Rattan is the product of the many species of climbing palms found in the tropical regions of the Old World. There is a large range of sizes, making the product adaptable to many uses. The thickness varies from one-quarter of an inch to 2 inches, and a length of 200 feet is not unusual. The larger sizes are used for canes and furniture, while the smaller ones are split to secure the outer part for caning chairs and the inner part or "core" for wicker furniture. The very small sizes are used in making baskets and other similar work. There are probably no finer rattans in the world than those which grow in the Philippine Islands. This is an industry as yet but little developed, as with a limited exportation, the local consumption is only about 6½ million pounds per annum. During the fiscal year ended June 30, 1914, unmanufactured rattan to the value of $4,240.56 United States currency was exported, of which the exports to the United States made up only $397. The importation of rattan into the Philippines for furniture manufacture is nearly four times greater. Locally the chief uses are for tying bales of hemp, tobacco, and other agricultural products. Especially since the European war has interfered with the Singapore market for rattan, the world's demand is directed more and more to the Philippines, and there is an exceptional opportunity for developing an extensive business in the Islands.

Manila copal or almaciga.—This gum, or resin, is obtained from a tree of the pine family known as *Agathis alba* and is commonly known in the Philippines as almaciga. The dried gum is very similar in appearance to amber and varies in color from light yellow to almost black. Its principal use is for the well-known copal varnish used in high-grade work such as on coaches and automobiles. The best quality is at present obtained from accumulated deposits at the bases of trees. Large lumps of almaciga, often weighing 100 pounds, can be found after all traces of the tree have disappeared. Locally it is graded according to purity into three or more classes. Although there is no organized or well-developed business in Manila copal, the Philippine Islands exported a quantity valued at $54,564 United States currency in 1913. The world's requirements for this product are still far from being met. This shortage could largely be reduced by the development of large forest tracts in the Philippine which produce Manila copal, or almaciga.

Other resins, gums, and oils.—Many trees in the Philippine Islands yield resins and oils of high potential commercial importance, but up to the present time their use has been largely restricted within local limits. One gum in particular, known as *Manila elemi*, promises possibilities of high development. This is derived from a tree known botanically as *Canarium luzonicum*, and popularly as pili. In 1913, 281,729 pounds of this gum were exported.

Yacal yields a resin which, while considered inferior to almaciga, is often mixed with it when sold by the collectors at the trading stations. Shipments of yacal resin to Europe are not infrequent.

The lauans could also be tapped for resin, as all species of the family are more or less resinous.

Various species of apitong yield an oil, or more properly a semifluid resin, known as balao or panao.

Two species of Philippine pines, which are very similar to the yellow pines of the United States, have been tapped for resin. They are found to be rich in turpentine, but at present it is not known whether they would justify exploitation on more than a very limited scale.

A true wood oil is derived from a tree of the Leguminosae (or locust family) known as supa or manapo, which is largely used by shipbuilders.

Lumbang oil is the product of the nuts of two species of Aleurites. These are closely allied to the trees from which the Chinese wood oil (candlenut or tung oil) is derived. This oil is highly valued by varnish manufacturers because of its transparency and quick-drying and noncracking qualities.

Tan barks.—The supply of hemlock and oak bark for tanning in the United States is no longer sufficient, and for many years there has been an increased importation of tanning materials from tropical countries, amounting now to about $6,500,000 per year. This consists chiefly of quebracho wood from South America, myrobolan nuts from India, mangrove bark from East Africa, gambier extract from Singapore, and bate, a chemical mixture, from Europe.

The Philippine Islands possess approximately 1,500 square miles of mangrove swamps, some of which are sufficiently extensive to warrant the erection of factories for the extraction of cutch, as the tanning material from the mangrove bark is called. A very important cutch industry has existed for years in the neighboring island of Borneo, and there is no reason why it should not be duplicated in the Philippines, especially in view of the fact that all Philippine products enter the United States free of duty.

Dyewoods and barks.—While a number of the woods, barks, and leaves of the trees and shrubs of the Philippines can be used for dyes, only one, sibucao (*Caesalpinia sappan*), is so used to any large extent. During the year 1913, 3,634,074 pounds of dyewoods, mostly sibucao, passed through official channels.

Nigi or tabigi (*Xylocarpus obvatus*) is a tree which is found in abundance in the mangrove swamps and the bark of which is used extensively for dyeing. There is no export trade in this bark, but it is used locally for dyeing sails, ropes, fishnets, cloth, etc.

Gutta percha and rubber.—Mindanao and other southern islands of the Philippine Archipelago furnish gutta percha of good grade and some rubber. The trees grow in the dense tropical forest and steps have been taken by the Bureau of Forestry to conserve them for a permanent yield. In 1913, although there was no organized collection of these products, 38,761 pounds, valued at $40,932 United States currency, were exported from the Philippines.

Paper pulp.—The various kinds of bamboo found in the Philippine Islands are probably put to more uses than any other single product. The domestic and industrial uses of bamboo are too numerous to mention. It has been found that one kind of bamboo in particular, namely caña-boho, is an excellent material for paper pulp, the cost of production being lower than that of wood pulp, while the quality is excellent. Surveys made by the Bureau of Forestry show that there is a sufficient amount of caña-boho in several localities to supply a pulp mill constantly with raw material. This is a matter which justifies very serious consideration on the part of paper manufacturers in the United States and Europe.

Fiber plants.—The number of fiber plants through the fields and forests of the Philippines is large. Many industries using such products may be developed in the Islands. The stems, petioles, midribs, leaves, air roots, and fibers from the stems and leaves are utilized for making baskets, hats, mats, ropes, textiles, etc. Among the plants used for this purpose are ferns, pandans, grasses, bamboos, sedges, palms, rattans, vines, and various other plants. The ferns are largely used for basket making; the pandans for mats, hats, and baskets; the bamboos and rattans for baskets and hats; and various palms for baskets, hats, and ropes. Sedges are made into baskets, mats, and ropes. Textiles are made from the fibers of pineapple leaves and from hemp. A fiber from a plant known as salago is exported to Japan where it is used in the manufacture of the best grade of bank notes.

All of the plants above mentioned have many other uses.

Soap barks.—There are many trees and vines in the Philippine Islands the bark of which has soaplike properties. The bark most commonly used for this purpose is that of the vine gogo (*Entada scandens*). This vine is abundant in all the forests of the Philippines. It is easily prepared by macerating and drying. Its most general use is for shampooing hair. Other soapy barks are available, but are less desired than gogo, of which about 2,000,000 pounds are collected annually.

Pili nuts.—These grow on the large forest tree known as pili (*Canarium luzonicum*) which is common in southern Luzon and neighboring islands. It is the general opinion of all who have tasted it that this nut deserves a place among the world's best table delicacies. Very little has been done in attempting to export the nut commercially or to improve the grade, although it is a prime favorite on Manila tables. Very few trees have been planted. The nut is used largely for confectionery by the Filipinos; and by visitors to the Philippines is generally considered superior to almonds. There is, however, some exportation for foreign use. During 1913, 635,921 pounds of nuts, valued at $22,269, were exported to the United States.

There are many fruits, spices, and other nuts used locally as food, but none of them have become as well known or as popular as pili nuts.

Wax.—The outlying districts in the Philippines furnish honey and beeswax in large quantities for sale in the neighboring towns. The supply is rather irregular, and the wax is principally used locally for making candles. Besides this local consumption, 60,931 pounds of beeswax, valued at $14,403, were exported to the United States in 1912.

Medicinal plants.—The number of plants used for medicinal purposes in the Philippines is very large. A few are recognized as sources of standard medicines, but the number having commercial value is decidedly small. From one, the St. Ignatius bean (*Strychnos ignatii*), the strychnine of commerce is extracted. Some of the other plants having medicinal properties are dita, datura, sibucao, macabuhay, bonduc, pili, and Aleurites sp.

Horticultural possibilities of wild plants.—One of the largest fields for investigative work in the Philippines is presented by the possibilities of developing, improving and utilizing plants now growing wild in the forests. Experiments with many of these plants have already been made and the results have shown that very beautiful flowers and shrubs for decorative purposes and fruits of very fine flavor can be obtained. There are undoubtedly many other plants and trees which will show satisfactory results. Some of the fruits of forest trees that are regarded with favor are santol, mabolo, duhat, wild mango, catmon, alupag, and the Philippine species of Chinese nut or litche.

More detailed information available.—The scope of a paper of this kind necessarily prevents more than a mention of the possibilities partially developed or latent in the forests of the Philippines. More detailed information will gladly be furnished by the representatives of the Bureau of Forestry in the Exposition Grounds, or else by application to the Director of Forestry, Manila.

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EXPORT TIMBERS

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EXPORT TIMBERS OF THE PHILIPPINES

THE Philippines possess a much greater supply of wood than will ever be used for local demands. The wood consumers of other countries can, therefore, find here a market that will furnish them a large and varied supply for practically all uses to which wood is put; large, because of the immense amount of certain widely useful species which can be obtained by the millions of board feet; varied, because the woods of few countries of equal size, if indeed any at all, can show a wider range of color, grain, hardness, strength, and other qualities demanded by special uses. It is no exaggeration to say that some species of wood can be found in the Philippine forests to suit almost any imaginable purpose the user may have in mind.

Export timbers fall roughly into four principal classes: Woods for interior finish and furniture, cabinet woods, woods for special uses, and heavy construction timbers.

1. *Interior finish and furniture woods.*—The prime requisite of a wood for these purposes is that it be at least fairly abundant. Also, it must be not very difficult to work and to finish, of good size, and last, but not least, of pleasing texture and color. All of these requisites are fulfilled by the woods of the dipterocarp (lauan) family. This family (to which belongs nearly three-fourths of the standing timber of the Islands) occupies the place that the conifers do in the North Temperate Zone, but possesses a wider range of color, hardness, and other qualities. The lauan group of the dipterocarps contains the greatest amount of timber specially fitted for interior finish and furniture. Tanguile, red lauan, and white lauan are obtainable in great quantities, have a fine ribbon grain when quarter-sawn, and, in texture and color, the first two resemble true mahogany and its substitutes very closely. White lauan differs from them only in color, being white with a very pale grayish-brown tint. It is pretty in natural finish where a light color is desired and, on the other hand, lends itself very well to staining. Almon, a very pale red lauan, is similar to white lauan as regards stains. All of these were little exploited and used during the Spanish régime, but the establishment of the steam logging industry has put on the market an ever-increasing supply, so that now large quantities are used for medium and high grade interior finish

and furniture. There can be no doubt but that the lauans will in time play an important part in the import trade of the United States.

The other woods of the same family, guijo and apitong, are also abundant. This fact and their greater hardness enable them to fill a demand for flooring in place of oak, red beech, maple, and other American woods which are yearly becoming scarcer. Guijo is light ashy brown to reddish brown and apitong is somewhat darker. Finished with wax or varnish, they range from reddish brown to dark chocolate. Both are hard and of rather fine texture. If a very hard wood is desired for flooring, yacal, the hardest and heaviest of the dipterocarps and the most abundant of the hard, heavy, and durable woods in the Philippines, will find a place.

There are several woods of other families which, though not as abundant as the lauans, are still to be obtained in sufficient quantities to supply industries that do not require many millions of feet per year. Such are lumbayao, pagatpat, and nato. Lumbayao is similar to red lauan in appearance, but is slightly harder and tougher and has a more conspicuous flake grain when quarter-sawn; nato is of similar color and texture, but of very homogeneous grain; pagatpat also is very even-grained, but of a rich dark-brown color.

There are also frequently used in the Philippines narra, tindalo, acle, molave, supa, calamansanay, ipil, and other hard, durable, and beautifully colored woods; for the export trade, however, these woods, on account of their beauty, comparative scarcity, and higher price, should be rather classified as cabinet woods.

2. *Cabinet woods.*—Of these the Philippines possess such an astonishing variety that it is difficult to give any idea of them in a short pamphlet. Foremost among this class on account of their large size, beautiful color, and grain and durability are the woods of the narra (or locust) family—acle, banuyo, ipil, narra, supa, and tindalo—all of which would delight the eye of every American maker of fancy furniture and cabinetwork. A dining-room set, a piano, a billiard table, or any similar piece of furniture made of one of these would attract attention at once no matter what comparison it might have to bear with other aristocrats of the lumber world. To attempt an enumeration of different classes of cabinetwork, naming for each one the various Philippine woods available would necessitate much unnecessary repetition. Perhaps the easiest way to give the cabinetworker a notion of what he may demand (and obtain!) for

his purposes is an enumeration of some of the better-known woods roughly classified by colors: Black—ebony; black, streaked or mottled with red brown or gray—camagon, ata ata, bolongeta (the Philippine persimmons); dark brown—dungon, ipil, mancono, pagatpat, pahutan; reddish brown—apitong, batete, betis, catmon, guijo, nato; red—amuguis, bansalaguin, calantas, nato, palo-maria, sibukao, tabigi, tucangcalao; grayish—banawi, macaasim, tabao; yellow—alintatao, bancal, baticulin, malacadios; pale straw color, creamy, or nearly white—kayutana, lanete, miao, white nato, molave. It must not be thought that the foregoing list is compiled with a view to color alone, any and every wood, good, bad, or indifferent, being dragged in to fill up; on the contrary, those named are all good woods, rarely attacked by boring insects, and not generally subject to discoloration except in the case of such light-colored woods as are easily stained by too slow or otherwise inefficient seasoning. In fact, the list could be doubled by including other woods used, on account of their varied color and grain, for musical instruments, fine cabinetwork, sculpture and carved articles, canes, hilts and sheaths for weapons, inlaid and mosaic work, desk and toilet novelties, picture frames, etc.

3. *Special uses.*—For bowling balls, bearings, stern shaft bearings, mancono has been used successfully. For the first-named purpose, dungon has also been found good. Bansalaguin, alupag, malabayabas, and tiga, all of fine texture, difficult to split, and very heavy, are recommended for experiment. For such articles as dumb-bells, paperweights, etc., requiring weight but not necessarily so fine and tough a texture, not only these, but a considerable number of other very hard and heavy woods are available.

For tool handles and other wooden parts of tools, there are generally required woods that are either hard or tough or both. Chisel and hammer handles and mallets especially need to be hard, tough, and difficult to split; for these agoho, betis, calamansanay, dungon, guijo, malugay, palo-maria, and yacal can be supplied; two of these, guijo and yacal, can be obtained in very large quantities, while the others occur in quantities sufficient to make tool handles, if not by millions, at least by thousands. Most of these, as well as many others equally hard or harder but not so tough, would supply turned and shaped handles such as grips and butt plates for braces and drills, plane and saw handles, plane bodies, scratch gages, scraper and drawknife handles, and hollow-tool handles.

For long agricultural tool handles, in which hardness is less essential than toughness and difficulty of splitting guijo, the hardest grades of lumbayao, malugay, mangachapuy, and yacal would make excellent substitutes for ash. The same species, with the exception of lumbayao, would make good axe handles.

For wagon tongues and other vehicle stocks, hubs, spokes, and felloes, an excellent material is found in guijo; it is not very heavy, but tough, difficult to split, and can be obtained in any size and quantity desired. Malugay, which is a little lighter, but equally tough, is not as abundant as guijo, but can still be supplied in fair quantities.

The cigar-box lumber *par excellence* of the world has for many years been the "Spanish cedar" of tropical America; in calantas is found a perfect substitute, so nearly identical in color, texture, and odor as to be almost indistinguishable. It is the only native wood used in Manila for high-grade cigar boxes. For cheaper boxes several of the lauans and nato are used.

Shuttles and spindles must be hard, rather tough, and resistant to abrasion. For these purposes a considerable supply of the sapwood of the trees of the camagon (persimmon) tribe could be furnished. Calamansanay and malabayabas are also recommended for trial in shuttles.

4. *Heavy construction timbers.*—A number of large trees furnish hard, strong, and very durable construction timbers. It is scarcely probable that the United States market will seek any considerable quantities of such material, except for very special pieces of work; but three species at least are to be mentioned as furnishing a supply of magnificent posts or beams for all kinds of heavy wooden structures, namely, ipil, pagatpat, and yacal. Allied to heavy construction is the use of timber for railway ties, durability and strength being the two qualities required. For this last purpose not only the three species above named are available, but at least twenty others are found, which, although they are not large enough or are not found in sufficient number to yield a great supply of large timbers, still can furnish ties for steam or electric railways. This statement refers, of course, to ties used without any preservative treatment. For treated ties, both the number of kinds and the supply available are much greater; practically all the lauans are very abundant and of great size and are probably susceptible to impregnation. They are about as strong as the medium-grade conifers, being less hard and heavy than Georgia pine, but somewhat stronger than the softest conifers. Beside the lauans, there are two harder woods avail-

able in great quantities, namely, guijo and apitong. These two properly treated would make very superior ties.

Following are brief descriptions and notes on some of the most important timbers of the Islands.

DIPTEROCARP FAMILY

White lauan (Pentacme contorta).—This is perhaps the most abundant and certainly the most widely distributed species of its family in the Archipelago. The wood is whitish with light-gray, yellowish, or very pale-brown tints. It is light, rather soft, with a fairly straight but slightly crossed grain, producing a narrow "ribbon" when quarter-sawn. It is used in the Philippines mostly for the cheapest kind of work, but would serve for furniture and interior finish of a fair grade, especially as it takes stain very readily and, though light and soft, is fairly tough and does not split easily.

Very near it in appearance and mechanical properties, and often sold mixed with it, is

Kalunti (Shorea sp.).—This is even lighter in color than white lauan and possibly a little softer and lighter in weight. It has not heretofore come into the Manila market in any great quantities nor under its own name; it is found, as far as known, only in Mindanao and some of the adjacent smaller islands.

Mangasinoro (Shorea sp.).—This is very similar to the above two species, but of a more decidedly yellowish tint. It is less abundant than either white lauan or kalunti.

Mayapis (Shorea squamata).—This is a very pale red lauan of straight-grained, smooth, glossy texture. It would make a very pretty veneer where a light red color is desired, but could also very readily be stained. It is less abundant than the following two.

Tiaong (Shorea teysmanniana).—This is intermediate in color and texture between mayapis and red lauan, being of a very uniform, light, glossy red. It is abundant in south-central Luzon, but very little, if any, comes to the Manila market, as no large operators have located in this region up to the present time.

Red Lauan (Shorea negrosensis).—This, as its scientific name indicates, is most abundant in the island of Negros. It is one of the largest trees in the Islands, reaching sometimes a diameter of 7 feet or over. Quarter-sawn, the wood has a beautiful ribbon grain which, with its red to dark reddish-brown color, has led to its being exported under the trade name of "Philippine mahogany," though it is not at all related to the mahogany family. Though the Philippine Bureau of Forestry has actively discouraged the use of this name, it had already become rather common in the States, so that any mention in trade journals of "Philippine mahogany" may be assumed in nine cases out of ten to refer to red lauan or tanguile. Red lauan has been used in the last few years in great quantities for interior finish and a good grade of furniture, together with a considerable amount of the next species.

Tanguile (Shorea polysperma).—This is the best of the group so far as concerns grain, figure, and hardness, though it has not the rich red color of red lauan. It varies considerably in different regions as to color and hardness. In Negros, where there is a deep, rich soil and excellent moisture conditions, it has a very rapid growth and is difficult to distinguish from red lauan, especially the red lauan from young or middle-aged trees, which is bright, clear red. In other regions, where it grows more slowly, the wood is denser and heavier and rather of a pinkish brown color. One or two firms who cut tanguile is such regions, sell it strictly under its own name, but generally speaking, tanguile and red lauan are mixed and sold indifferently under either name.

Apitong (Dipterocarpus grandiflorus and several other species of the same genus).—The woods of this group are considerably harder and much heavier than those of the lauan group. Apitong ranges from pale grayish red to dark chocolate in color. It is rather close and straight grained, but when strictly quarter-sawn has often a very pretty wavy grain forming diagonal stripes across the board. Though it is somewhat resinous, the resin does not break out through varnish if the lumber is thoroughly dried before finishing. It is used in the islands to a very considerable extent for flooring and other interior work, as well as for a great variety of medium-grade furniture. Especially the darker grades of apitong (although, for that matter, like the lauans, it can be stained) would make a very handsome and substantial appearance.

Guijo (Shorea guiso).—This wood, though of the same genus as the lauans, is in quality much more like apitong. It is hard, heavy, fine grained, but tougher and much less resinous than the latter. In color it ranges from light ashy red to dull reddish brown. Though the greatest bulk is used in the Islands for general construction, ship and boat building, and vehicle parts, it is also much used for flooring, interior finish. and furniture. It is not very difficult to work and, on account of its dense texture, takes a fine finish.

Mangachapuy (Hopea acuminata and several other species of the same genus).—Mangachapuy ranges from soft to rather hard, but all grades are of about the same color, a very pale yellowish white which, on exposure, rapidly turns to dark yellow or even yellowish brown. Sometimes the fresh timber shows bright green streaks which in time turn to dark greenish brown. It is of a very homogeneous and straight-grained texture. It is a favorite in the Islands for oars, spars, ship decking and planking, moldings, and similar purposes where a clear, straight-grained wood is required. The golden-brown tint it acquires on exposure makes a very pleasing effect in combination with woods of contrasting color. It is unfortunately one of the least abundant of its family.

It is difficult to draw an exact line of demarcation between the mangachapuys and the woods known to the trade as—

Yacal (Shorea balangeran, and perhaps other species; Hopea plagata, H. mindanensis, Hopea ovalifolia, and other species).—These are, with the exception of narig, the hardest and heaviest woods of the family. Although belonging to a number of different species of two distinct genera, they differ so little in quality that for practical purposes they may be described as one. Yacal is very hard, very heavy, tough, dense, of fairly fine texture, somewhat cross-grained, rather hard to work, and of a dull yellow color changing in time to very dark brown. It is little used for furniture in the Islands, the chief objections being probably that it is slow to season, liable to warp if not carefully and thoroughly seasoned, and finally that it is much harder to work than guijo and mangachapuy and has not the brillant color which is one of the chief attractions in a cabinet wood. When well finished, however, it is very handsome and in strength and durability equal to or superior to the best of the oaks and hickories.

Narig (Vatica mangachapoi, and other species of the same genus).—This is the heaviest, densest, and finest grained wood of the family, in color and texture so much like the yacals that it is generally sold with them. It differs notably from yacal in only one respect, namely, that it is almost perfectly straight grained, therefore showing no ribbon at all when quarter-sawn and being consequently considerably easier to finish.

LEGUME OR NARRA FAMILY

Next in importance to the dipterocarps are the members of the narra, or, as it is known in North America, the locust family. This furnishes a number of brilliantly colored, hard, and durable cabinet woods, which are among the best and most widely known in the Islands. Only the best known and most abundant species will be described here. The use of the word "abundant" here is relative only; none of the following are as common as even the least abundant of the dipterocarps.

Acle (Albizzia acle).—Of all Philippine woods, this is almost the only one that in color and mechanical properties closely resembles black walnut; by a curious coincidence, it is also the only one that has a pungent, peppery odor, the shavings and dust (especially when worked with machinery) causing violent sneezing. It is often curly, wavy, and cross-grained, producing a conspicuous, florid figure, especially on the flat or bastard grain. It is practically never attacked by insects. Acle is one of the finest cabinet woods in the Islands and would make beautiful veneers, either rotary, flat sawn, or rift sawn.

Banuyo (Wallaceodendron calebicum).—Banuyo is very similar in figure to acle, but it is considerably softer and is of a pale golden brown to dark coffee color, sometimes with a decided reddish tint. It is easy to work and of a smooth, glossy texture. Banuyo bends transversely with ease and therefore is a favorite for curved carriage panels; it is also much used for carved articles, such as ornamented picture frames, as well as for furniture and for interior finish in houses and ship cabins.

Batete (Kingiodendron alternifolium).—This is somewhat harder and darker than banuyo, often with alternating belts of light and dark brown. Compared to other woods of its family, it is but little used, though it is widely distributed and of large size. This is probably due to the fact that it is liable to warp if not piled carefully while seasoning and also to the dark oil that exudes from all sections, staining the surface almost black. This oil, however, does not break through good varnish and under such a finish the wood retains its handsome reddish brown color.

Ipil (Intsia bijuga and I. acuminata).—This wood was little used for furniture by the Filipinos and Spaniards. It is rather difficult to work, very heavy, and changes on exposure from its natural yellow color to a very dark, dull brown. It is, however, an excellent wood, being very durable and extremely stiff and strong, and under a good finish assumes and retains a very handsome and rich dark golden brown color. Ipil is one of the woods exported to Europe from the Malayan region and is sometimes known as ironwood.

Narra (Pterocarpus indicus, P. echinatus, and P. blancoi).—The wood of these three species (which are indistinguishable) is by far the most widely known cabinet wood in the Islands. It occurs in practically all the forested islands, is easy to recognize both in the forest and in the lumber yard, is easy to work and insect proof, has a pleasant odor, a beautiful grain, and brilliant coloring, ranging from very pale yellow through all shades of salmon and red to deep blood red. Besides all this, it shrinks but little and warps hardly at all. It is used literally for all kinds of interior finish and furniture. Also, as mentioned above, one-piece round tables are oftener made of it than of any other wood.

The first species of the three named above is identical with the padauk of India.

Supa (Sindora supa).—This as a hard, heavy, fine, and very dense wood; yellow when fresh cut, turning on exposure to a rich, glossy, golden brown. Slash-sawn, it has a large, florid figure, like most of the woods of the family; and quarter-sawn, a broad, wavy, irregular (sometimes diagonal) "ribbon." It is a favorite for flooring on account of its hardness and smooth texture. It makes most beautiful paneling and furniture. A paneled room and dining set of supa will be shown in the Philipppine exhibit at the Panama-Pacific Exposition.

Tindalo (Pahudia rhomboidea).—Tindalo irresistibly suggests the adjective "gorgeous." Pale orange when fresh cut, it turns rapidly to a deep, glowing, orange red which becomes ever richer with age. This, with the very broad, florid figure it shows when slash-sawn, makes it altogether one of the most conspicuous things in any collection of different woods. In addition to its hardness and brilliant coloring, it has the virtue of shrinking very little and of warping hardly at all. If it is less used for furniture and interior finish than is narra, this is probably due only to its being less widely distributed and somewhat scarcer.

No tree family besides the dipterocarps and legumes furnishes anything like the bulk of timber that these do. The following belong to almost as many families as there are species mentioned:

Bancal (Sarcocephalus orientalis).—Not a very important wood, but worthy of mention on account of its unusual color, a bright sulphur yellow, sometimes with greenish or brownish streaks. It is soft, of very homogeneous texture, very easy to work, and durable. It is used for inside finish, carved work, medium-grade furniture, household utensils, etc.

Benguet pine (Pinus insularis) and *Tapulao* (P. merkusii).—These two pines are found only in three strictly limited regions, and the timber has never been brought to the Manila market. The heartwood is very resinous and heavy, resembling closely that of the yellow pines of America. In the Mountain Province, where through a certain region almost no other large trees are found, Benguet pine is used for all purposes.

Ebony (Maba buxifolia).—Ebony is widely distributed in the Philippines, but the trees are scattered and small. The writer has seen no log (and heard of only one) having more than 8 or 9 inches of heartwood. The heartwood is jet black and sharply marked off from the white or grayish sapwood. Ebony is used for fancy cabinetwork, carved jewel boxes, inlaying, canes, sword hilts, scabbards, shuttles, etc. It is, bulk for bulk, the highest-priced wood in the Philippines, selected perfectly clear pieces bringing prices equivalent to about $300 per 1,000 feet board measure.

Camagon (Diospyros discolor, and other species of the same genus, belonging to the same family as ebony and as the American persimmon, Diospyros virginiana).—The sapwood is large and generally pinkish or pale red. The heartwood is generally black with streaks, and mottlings of ashy or brownish red. It is almost as hard and heavy as ebony, and is put to the same uses. It makes very beautiful veneers.

Calantas (Toona calantas, and other species).—This is closely related to, and to all practical intents identical with, the Spanish cedar (Cedrela odorata) of tropical America. It is the only native wood used in Manila for high-grade cigar boxes. It is also valuable for wardrobes, bookcases, clothes chests, etc., as its strong odor keeps out moths and weevils.

Lumbayao (Tarrietia javanica).—This wood is very similar to red lauan in general appearance. It varies from very pale red to dark reddish brown in color and is somewhat harder and heavier and much tougher than red lauan. It is an excellent and beautiful wood for veneers and for interior finish and furniture.

Malugay (Pometia pinnata, and probably other species of the same genus).—This wood has never been brought to the Manila market in great quantities, but it is relatively abundant in some regions and will probably play a greater role in the future than the present. It is the toughest known among the moderately hard and heavy woods and will no doubt make very good material for baseball bats, wagon tongues and other vehicle stock, axe and other tool handles, etc. It is pinkish to dull red in color and of rather fine texture. It has been used for flooring and interior finish, boats and launches (ribs, planking, and cabin work), and furniture.

Mancono (Xanthostemon verdugonianus).—This is the "ironwood" *par excellence* of the Philippines. It is one of the hardest and heaviest woods of the world, being a trifle heavier than average lignum vitæ and a little harder. For posts and piles it is almost indestructible, even the vocacious teredo digging only a little way into the thin sapwood in the course of twenty or thirty years. It has been used with excellent results for stern bushings in steam launches and for bowling balls. It can be polished almost like a metal and makes very beautiful dumb-bells, canes, desk novelties, etc.

Molave (Vitex parviflora, and other species).—This is the best known of the hard, heavy, and durable woods of the Philippines. Throughout the Islands its name is a synonym for strength and stability. Molave is hard to very hard; heavy, of very fine texture, and ranges from pale straw color to light brown; it is rarely or never attacked by insects unless it has been previously softened by decay. It has only one defect—its lack of toughness, which unfits it for long beams. It is put to almost every conceivable use in construction (with the exception just mentioned) as well as for agricultural, industrial, and household implements, and for high-grade furniture.

Molave works easily with all kinds of tools. It would make a fine veneer where a fine-grained, light-colored wood is desired.

Pagatpat (Sonneratia pagatpat).—This is perhaps botanically identical with the prapat (Sonneratia alba) of the Malayan region. At any rate, the wood of the two species is the same. It is pale to dark chocolate brown, under varnish becoming nearly black. It is hard, heavy, and of very even texture and straight grain, and easy to work. It has only one defect, namely, that it contains a considerable amount of common salt, causing small iron nails or screws to rust out rapidly. It is used for all kinds of general construction, shipbuilding, flooring, interior finish, and furniture; also for piles, poles, railway ties, and paving blocks. It would make a beautiful veneer of an even, dark walnut color.

Palo Maria (Calophyllum inophyllum).—This is a very beautiful wood, being of a pale red to reddish brown. It is of very fine texture, with crossed, curly grain, marked with frequently recurring, characteristic, fine zigzag lines formed by cutting through the numerous, wavy, concentric belts of soft tissue which constitute one of the typical features in the cross section. It is a hard wood and difficult to work, but would make a most beautiful veneer.

NOTE.—Additional and detailed information about the above and a great number of other Philippine woods is found in the following publications:

1. Philippine Woods, F. W. Foxworthy, Philippine Journal of Science, 2 (1907), Botany, pp. 351–404.

2. Indo-Malayan Woods, same author, Philippine Journal of Science, 4 (1909), pp. 409–592.

3. Mechanical Tests of Thirty-four Philippine Woods, by Rolland Gardner, Bulletin 4, Bureau of Forestry, 1907. (Abstract reprinted as insert for Bulletin 11.)

4. The Forests of the Philippines, by H. N. Whitford, Bulletin 10, Bureau of Forestry, 1911. (Two volumes, profusely illustrated, $1.25 postpaid.)

5. The Uses of Philippine Woods, Bulletin 11, Bureau of Forestry, 1911. (Pamphlet, 50 pp., with above-mentioned insert, 20 pp., $0.30 postpaid.)

Samples of all of the commercial woods of the Philippines can be obtained by addressing the Director of Forestry, Manila, or at the Bureau exhibit at the Panama-Pacific Exposition. Each sample is ⅜ by 4 by 6 inches, and bears a label with the scientific and common name of the wood. With the exception of 21 species which sell at 20 cents, the price per sample is 10 cents U. S. currency, postage prepaid.

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THE PHILIPPINE ISLANDS

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OCT 8 1915

PAPER MATERIALS

in the

PANAMA PACIFIC
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PAPER MATERIALS

FROM the earliest Egyptian papyrus to the paper of to-day, the predominant characteristic of the material is that it consists of the enduring portions of vegetable growth known as cellulose, although animal and mineral fibers, such as wool, silk, and asbestos, are occasionally employed.

In 1854 wood pulp was first used in the United States, and three years later Mr. Thomas Routledge introduced esparto grass into England.

For half a century wood pulp has met the rapidly increasing demand for paper stock. However, we are now confronted with the fact that the supply of this material will soon be exhausted, and we are back at the point we were before the introduction of wood pulp, and must search for some substitute.

A recent report of the United States Department of Agriculture recommends an investigation as to the suitability of new raw materials for paper and paper pulp. Efforts are being made to utilize bagasse or sugar cane refuse, cornstalks, southern pine waste, rice straw, and hemp stalks. England in 1861, and later, contemplated the throwing open of the Indian bamboo forests to private enterprise in order that the increasing demands for paper and paper-pulp material might be satisfied. Mr. Thomas Routledge sent men to India to investigate the problem in that country. At about the same time the manufacture of paper stock from spruce had been developed on the Continent, and supplies of this new material brought the much-needed relief. Nevertheless, experiments were carried out which demonstrated that bamboo fiber is much superior to spruce for paper stock.

Subsequent experiments have shown that bamboo pulp can be worked the same as wood pulp, and that no alteration in the machinery is necessary. The paper takes both letter press and lithographic work admirably.

Among the fibrous products of our tropical and subtropical forests, none is more likely to take a leading place as a paper-making material than bamboo. Its accessibility, being found within easy reach of waterways; the size of the stems, giving a larger return per head per day for the cutting force than the smaller annual grasses; the ease with which it yields to the same methods of treatment as have been so successful with wood, together with its greater abundance, mark it out as the fittest and most natural successor to the position occupied by spruce and pine trees during the last thirty years Its power of self-production renders impossible an exhaustion of supply, as has occurred with spruce and pine.

Recently a survey was made of Bataan Province, Luzon. This survey shows that there are two regions, one of 1,970 acres and another of 1,600 acres, which are well covered with bamboo. Much of this area is near waterways and easily accessible. It is estimated that an area of 2,470 acres of bamboo would supply a pulp mill of 20 tons' daily capacity for three years of three hundred working days each, not taking into consideration the growth of the bamboo during this period; or, working on a three-year rotation, which is entirely feasible, such an area would supply a mill of this capacity indefinitely. There is no limit to the bamboo supply of the Philippines.

One of the chief difficulties in the manufacture of paper pulp in the Islands is the necessity of importing the chemicals used in the process either from the United States or Europe, with the consequent higher cost of production. A solution of this problem would be the electrolytic decomposition of salt, which is found in large quantities here, thus preparing both the alkali and bleach on the spot.

In spite of the necessity of importing chemicals, the maximum estimated cost per ton of unbleached paper pulp produced is only $21 (free on board) in Manila. This would insure the manufacturer a handsome profit.

Typical bamboo (*Schizostachyum*) forest, Bataan, Luzon.

Besides bamboo, there are other sources of raw material. Two grasses, cogon and talahib, grow wild in the Philippines in sufficient quantities to be of economic importance. Cogon grass is as readily worked into paper pulp as esparto grass, which is being used in Europe, and yields practically the same quality and quantity of cellulose. Talahib is generally distributed throughout the Archipelago and is frequently confounded with cogon grass.

It is very different from the latter, however, in appearance and in its habit of growth. When dry it is somewhat more difficult to convert into pulp than is cogon grass, but when the right stage of growth is chosen it yields readily to treatment, producing a good yield and a fine quality of paper pulp.

Abacá, or manila hemp as it is sometimes termed, is a species of wild banana. So-called manila paper has long been made from worn-out ropes of this fiber. Its superior quality for the manufacture of special kinds of paper where strength is the desideratum is well demonstrated. According to the Twelth Report of the United States Census, American paper manufacturers purchased approximately 100,000 tons of so-called manila stock for use in their mills; the approximate cost was $2,500,000, or $25 per ton. This stock was made up of old, worn-out rope, gunny sacks, waste thread, and binder twine; it also included jute butts and waste.

After abacá, maguey, or sisal hemp may well be ranked as the second most important fiber-producing plant of the Philippine Islands. It, like abacá, is used for cordage and likewise finds its way to the paper mills in the form of old rope, binder twine, etc.

The banana and plantain are also well worth considering as regards their availability for paper stock. The Philippines and the Malay Archipelago are the regions richest in bananas. The entire cultivated area devoted to bananas was reported as being 83,802 acres, upon which 14,078,600 bunches of the fruit were said to have been produced. This also represents the number of stalks which practically go to waste at the present time, for after the fruit is harvested they are allowed to rot on the ground. These data do not include the wild nonedible species of bananas which are so common in all parts of the Islands. These plants are easily worked into paper stock of good quality.

The palms which might be used for the preparation of paper pulp include the betel nut, nipa, buri, and coconut palms.

Several woods are available for the manufacture of paper. In Bataan Province, in one wooded section on Binouañgan River, the estimated total stand of *cupang, lauan,* and *mayapis,* is given as—

	Cubic feet.
Cupang	1,870,720
Lauan	1,578,960
Mayapis	1,040,400
Total	4,490,080

This includes only the merchantable stand in the basin, after making an average deduction of 20 per cent for unsound timber; hence, 5,000,000 cubic feet of pulp wood may be obtained from this one small area. The merchantable stand of timber on 11,339 acres of public forest on the eastern coast of Mindoro shows a yield of 14,060,800 cubic feet; of this amount, 6,453,400 cubic feet are white lauan. These trees all yield an excellent quality of paper pulp.

In the search for a supply of paper-stock material, attention is being turned to the Orient, and the Philippine Islands will soon claim their place and share in this new industry of the Tropics.

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The manufacture of paper from orange pulp. *Phil. Journ. Sci., Sec. A* (1912), 7, 411–414, No. 6.

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OCT 8 1915

CEMENT RAW MATERIALS

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CEMENT RAW MATERIALS OF THE PHILIPPINES

REINFORCED concrete is the only construction material approved with any degree of unanimity by engineers for structures which are to resist the effects of earthquakes. As a consequence it has been employed for first-class construction in the Philippines since American occupation to the practical exclusion of other building material. The cement used for concrete in the Philippines is imported, and for a number of years the importations have amounted to more than 300,000 barrels annually. There is a duty of 30 cents a barrel on imported cement, which, with transportation charges, has kept the cost generally above $2 a barrel. Formerly the bulk of such cement was secured from Hongkong and French Indo-China, but during the past year the imports from Europe have increased until they now constitute more than half the total. Strange as it may seem, American manufacturers have not taken advantage of the Philippine market in spite of the fact that American cement enters the Philippines free of duty, thus enjoying an advantage of 30 cents a barrel in price.

Lack of capital and the high price of fuel have prevented the local manufacture of cement up to the present time, but there is now under construction at the town of Binangonan, near Manila, a rotary plant for cement manufacture. Here, again, the Philippines have borrowed from Europe rather than America, both in the capital which is represented and in the machinery which is being installed. The new company, known as the Rizal Cement Company, has purchased German equipment exclusively. The plant is under the direction of

German technical men, and German methods of manufacture are to be followed. The initial capacity of the new plant will be only 30 barrels per day, an output which is not sufficient to meet the local demand, but which will undoubtedly be increased after the plant is once established.

The Bureau of Science has devoted considerable attention to the possibility of manufacturing Portland cement in the Philippines, and has indicated a number of places at which such manufacture could be carried on advantageously. In the Visayan Islands, more particularly on Cebu Island, there are large deposits of an impure coralline limestone, the composition of which approaches very closely to that of a raw mixture for Portland cement. This limestone is exceedingly soft, occurs in such relations that it may be quarried without the removal of any overburden, and is found adjacent to existing railroads at sites which possess also natural harbor facilities. Clay suitable for admixture with this limestone, which in reality only requires 6 parts of clay to 100 parts of the stone itself to produce an appropriate mixture, is likewise available at the plant site. In addition there are undeveloped deposits of coal within a distance of a few miles, of such character that it could be successfully used for burning Portland cement in rotary kilns. While Manila is, at this time, the chief distributing point for the Philippine Islands, yet Cebu, by reason of its central location, offers a better situation from which to distribute products manufactured locally. Altogether, the conditions at the proposed plant site in Cebu are specially adapted for the manufacture and marketing of Portland cement.

Aside from the coralline limestone in the Visayan Islands, which might correctly be classed as a cement rock, there are in the Philippines abundant and widely distributed formations of practically pure crystalline limestone. With these are usually to be found suitable siliceous materials for a cement mixture such as clay, shale, or volcanic tuff. The Rizal Portland Cement Company will use such a limestone which is found in the mountains about 4 miles from the town of Binangonan. For the required siliceous material to combine with the limestone, they will quarry a fragmentary andesitic tuff which is encountered adjacent to the limestone quarry site. Both materials will be brought to the mill over an aerial cableway. Fuel for this plant will be imported, and will come through Manila, with which port the plant has communications by water. The crystalline limestones generally, as in this case, are found in more or less mountainous regions, and they possess the further disadvantage of being exceedingly hard and, therefore, more difficult to quarry and crush than the Visayan coralline limestone. The volcanic tuffs in the Philippines generally are better adapted for Portland cement mixtures than clay and shale by reason of their chemical composition. On the other hand, while some of the tuffs are exceedingly fine grained and very uniform, a great many others are made up of larger fragments and are, therefore, not homogeneous.

Natural cement could be manufactured in the Philippines from the same raw materials which are proposed for Portland cement. The Visayan coralline limestone might be burned alone to produce a natural cement, but elsewhere it would probably be necessary to burn an artificial mixture of raw materials, employing a lower temperature than is required for Portland cement.

The Philippine penal colony at Iwahig, Palawan, manufactures its own construction material. In the past the colony has confined itself to making bricks, but it has recently been pointed out that fine coralline sand which is found in great quantity adjacent to the colony might be used with brick clay for the production of a natural cement. Natural cement would serve the same purpose as the brick which has been used heretofore and which is not of good quality. The manufacture of natural cement would not require the investment nor the precise manipulation which is entailed in the manufacture of Portland cement.

The imports of Portland cement into the Philippine Islands during the year 1913 amounted to 425,000 barrels, the invoiced cost of which, exclusive of duty and local wharfage charges, was $1.90 a barrel. On the Manila market cement brings from $2.25 to $2.75 per barrel. The demand for Portland cement in the Philippines is sufficient to absorb the entire output of a single small manufacturing plant, and the current price for cement is sufficient to leave a handsome margin of profit to the manufacturer.

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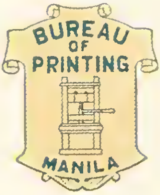
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GOLD IN THE PHILIPPINES

AS has been often remarked, there is scarcely a province in the Philippine Islands where gold is not obtained in small quantities by Filipinos who are skillful at panning, and clever at recognizing the evidences of mineralization. Because of primitive methods and equipment, only shallow alluvium and free-milling surface ores have been accessible, but operations in this field are of exceeding long standing and of considerable magnitude. It is reliably stated that Chinese writings of the third century, A. D., report gold as the principal product of Luzon. The Spanish explorers, with their traditional lust for gold, were quick to discover and take advantage of this resource in the Philippines, yet the best Spanish records indicate that mining was carried on with more energy before the Spanish conquest than it was afterwards. Early in the seventeenth century the production from one district near Paracale, Camarines, was about $200,000 per year. It is significant that, with all the mining activity following American occupation, prospectors have been guided principally by the evidences of former Filipino workings, and no important deposits have yet been located which are not literally honeycombed at the surface with the shallow pits and tunnels of these olden days.

The workable deposits of gold in the Philippines have been found principally in rocks of Tertiary or more recent age, although it is well established that crystalline and matamorphic rocks, which are generally believed to be the earliest part of the Philippine geologic column, carry almost invariably a trace of gold.

The economically important mineralized areas

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have been found usually associated with intrusions through the older rocks and into overlying, more recent andesites and other surface rocks, including, in rare cases, sedimentaries. The gold is found usually in true veins or filled fissures, but the walls are often much mineralized and are not sharply defined. Quartz is the commonest gangue mineral, and the principal mineralized districts show evidences of extensive silicification outside the veins proper. Calcite is also a common gangue, and ribbon structure with alternate bands of quartz and calcite is characteristic of the ore in several of the producing mines. The veins which are filled exclusively with calcite, however, are usually leaner in values than the straight quartz veins. Likewise, oxides of manganese are characteristic gangue constituents. The ores which are at present exploited commercially are usually of manganiferous quartz-calcite composition.

Native miners at work in drift of eastern mine.

Pyrite is always found in the gold-bearing quartz, and not infrequently copper sulphides accompany the pyrite. Gold associated with galena is less common, but has been noted especially in calcite veins in slate. Silver occurs with the gold apparently as an alloy in proportions varying up to 20 per cent of the gold.

A striking feature common to all the principal gold districts in the Philippines is the large number of veins which are to be observed. The veins which are being exploited vary in width up to 130 feet; but usually the values are not of economic importance throughout such great widths. The average tenor of the commercial ores is from $10 to $15 per ton. It is commonly found that the ore is not uniform but that both richer and poorer assays are obtained from samples across a vein of this average value.

The typical Philippine ore is not free milling; only about 30 per cent of the gold can be obtained by amalgamation. The ores yield readily to cyanide treatment, and all the operating mills employ this process of extraction.

The principal gold-mining districts in the Philippines are the Baguio and Lepanto regions in the Mountain Province, the Aroroy district in Masbate, the Paracale district in Camarines, and the Cansuran district in Mindanao. The first two are lode-gold district; the last two are placer-gold districts.

In the Lepanto district there has been no attempt to recover gold by modern processes; the only production is from the operation of the native inhabitants, particularly the Igorots.

In the Antamok and Gold Creek Valleys near Baguio there have been several mills in operation since American occupation. The Headwaters, Benguet Consolidated, the Bua, and Camote-Clayton on Antamok River, and the Major mines on Gold Creek, have all had mills in operation throughout short periods. The mills of the Benguet Consolidated and the Bua mines operated successfully until they were destroyed by floods. Antamok River is subjected to violent freshets, and the mill of the Benguet Consolidated Company was destroyed, rebuilt, and destroyed again in this way. The owners have recently succeeded in interesting the required capital, and have purchased the machinery for another larger mill which will be erected during the next few months. The Bua has never recovered from the loss of its first mill. The Headquarters mine has a 10-stamp cyanide mill which is at present idle. The Headquarters property is generally considered favorably, but through failure to maintain exploration, the ore supply is not at present adequate to the requirements of the mill. The Camote-Clayton is a small property with an improvised 3-stamp amalgamation mill which has been a consistent, though small, producer for several years. The Major mine supported a small mill for a short period of operation, but is now closed. The principal difficulty with all these properties has been lack of capital.

The ores in the Baguio district include both calcite and quartz ores and ores composed of an intimate mixture of these gangues. Manganese is prominent in most of the ores. There is an exceedingly large number of veins in the Baguio district. These veins in the Antamok Valley appear to be related genetically to an intrusion of quartz diorite into overlying volcanic rocks. In the Gold Creek Valley sedimentaries are found in the overlying rocks, and the ore body of the Major mine is located more or less closely upon the contact of sedimentaries with the intrusion. Aside from the mines which have operated, there are a number of promising claims under exploration. In the valley of Antamok River, particularly, there are large bodies of quartz ore, and it would seem that intelligent application of modern methods of treatment might be successfully employed if several of such properties could be consolidated. The ore which has been milled in the past carried from $10 to $12 gold per ton. Occasional assays showing a much higher value have been obtained, but it is probable that if larger-scale operations were initiated they should depend upon ore of somewhat lower grade than that which has so far been treated.

Colorado gold-extraction mill.

In the Aroroy district in Masbate the ore veins are in andesite, and are filled with manganiferous quartz-calcite ore. The district is situated upon the intersection of two prominent tectonic lines, and fissuring with subsequent mineralization has been extensive. The principal mines are the Colorado, the Syndicate, and the Keystone. Each of these properties has a developed ore body, and is equipped with a mill designed for extraction of fine grinding and cyanidation. The combined capacity of these mills is from 250 to 300 tons per day, and the ores carry from $10 to $15 per ton in gold.

The Colorado mine has been operating consistently for three years, and has made an enviable record. The Syndicate and Keystone mines began operation early in 1914, and there is every reason to believe the district will continue to produce for an indefinite period. As in the Baguio district, there are numerous prospects around Aroroy, and considerable areas of promising country which have not yet been prospected.

The Paracale district in Camarines Province is essentially a placer-gold district, although lode mining has been attempted there in the past. It was this district which first attracted the attention of Spanish explorers, and from which the principal Spanish production came.

The gold at Paracale occurs in veins which are largely confined to a comparatively small area of granite which is apparently intrusive, with an older peridotite on one side and Tertiary sedimentaries on the other. Region metaphorphism has rendered the granite gneissic with peridotite schistose, and has folded and crumbled the sedimentaries.

The San Mauricio mine workings are in the granite near its contact with the schist. The ore is refractory with a gangue of quartz and with copper and iron sulphides, but, unlike the Baguio and Aroroy ores, contains neither manganese nor calcite. The Tumbaga mine has worked upon small calcite veins and stringers in slate and andesite near the contact of the granite with the sedimentaries. The Tumbaga ore is strikingly rich in free gold which is associated in the calcite with galena. Telurides have been detected in the Tumbaga ore, an occurrence

The Gumaus dredge "Governor Gilbert."

which, so far as known, is unique for the Philippine Islands.

The placer deposits in the Paracale district are exploited entirely by dredging. At the present time 7 large dredges are in operation, and additional dredges are under construction. The dredging is divided between American and Australian capital, and, in consequence, two types of dredges have been introduced, both of which are operating with apparent satisfaction to their respective owners.

The gold is confined to a thin bed of sandy gravel, and is buried beneath from 30 to 50 feet of barren clay overburden. The bed rock is gneiss and schist, and affords a good floor upon which to work. The gold-bearing bed varies from a few inches to a few feet in thickness, and is exceedingly rich. The Gumaus Company operating in ground up to 52 feet in depth, and with pay gravel never more than a few feet in thickness, has taken out values which make the average of all the material handled nearly 50 cents per cubic yard. The Paracale gold is usually fine, very sharp, and often crystalline. It is not uncommon for the dredges to bring up quartz bowlders carrying considerable visible free gold. There is every indication that the gold-bearing gravel has not traveled far, but lies near the vein from which it was eroded. Each of the several rivers upon which dredges are working in the Paracale district are tidal, and the operations are carried on in brackish water. The dredges use wood from the surrounding mangrove swamps for fuel. The combined production of the Paracale dredges was about $335,000 during 1913 and about $400,000 in 1914.

The principal holding company in the Cansuran district in Surigao is the Cansuran Placer Company which has just completed the installation of a hydraulic mining plant. The Cansuran property lies on the extreme northern part of Mindanao Island, in a district which has long produced gold through the efforts of Filipinos. The values on the Cansuran Company's claims have been estimated by conservative engineers as at least two and one-half million dollars. The gold in this district is found in both modern and older gravels in an upland region. The gravels are 10 to 15 feet thick, and consist principally of sand and small pebbles. The gold is well rounded and comparatively coarse. A number of nuggets weighing as much as 30 grams have been recovered from the claims which are to be exploited. Very little is known of the geology of the region, but the gravels generally lie upon a schist, and appear to have been carried down from the mountains, which lie farther inland.

Minor Philippine gold-producing districts include a large area of placer ground in Nueva Ecija Province, which is of comparatively low unit value. The exploitation of this district has been prevented by the low value and by the character of the deposits which contain a great deal of clay.

The Umerai Gold Limited operates a dredge on Umerai River in Tayabas Province on the east coast of Luzon. This dredge has not been operating long enough to prove the value of this region. A number of claims have been located on the Umerai River, and the few tests which have been reported indicate commercially important placers.

Mindoro Island has received considerable attention from prospectors, and it is known that gold occurs on several of the larger rivers. The most promising samples have been obtained on Binabay River in the northern part of the island. Here, as in Surigao, the gold is coarse and rounded, several nuggets of 10 grams' weight having been brought in.

Catanduanes Island in Albay Province is known to contain two small placer-gold areas, but these have not as yet been exploited.

The mining laws of the Philippine Islands are based on those of the United States. The principal point of difference is that the Philippine law grants no extra-lateral rights. Each locator is entitled to one claim only upon a single lode in the Philippines.

All dimensions are stated in meters, lode claims being 300 meters square. There is an export tax of $1 per ton on Philippine ores.

The total gold production for the Philippine Islands has grown from less than $100,000 in 1907 to more than $800,000 in 1913, while the production in 1914 will be about $1,125,000. The gold production in the future will come from both the placer-gold and the lode-gold deposits, and it may be expected that the supply from both sources will be materially increased and will be maintained for an indefinite time. The local conditions are such that adequate capital is essential to the success of even small enterprises. The Philippine mining industry is emphatically not a poor man's field. The comparative slowness with which gold mining has progressed in the past has been due in great part to lack of capital, and satisfactory progress in the future is conditioned absolutely upon a sufficient investment.

BUREAU
OF
PRINTING
MANILA

OCT 8 1915

THE PHILIPPINE ISLANDS

THE BUREAU OF PRINTING

in the

PANAMA PACIFIC
INTERNATIONAL EXPOSITION
SN. FRANCISCO CALIFORNIA

A brief description of the Bureau of Printing plant its productions and apprentice instruction

The Government of the
Philippine Islands

1915

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DIRECTOR OF PRINTING

SAMUEL H. MUSICK
ASSISTANT DIRECTOR OF PRINTING

CLARK E. WAGONER
RECEIVER OF WORK

JOHN H. McQUERRY
IN CHARGE OF MISCELLANEOUS DIVISIONS

CRAFTSMEN-INSTRUCTORS

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HENRY F. FINKENHOEFER
WALTER W. WEBER
WALTER R. JOHNS
JOHN F. McLENNAN
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CHARLES E. DOTY
SAMUEL MacLACHLAN
JAMES P. RICHARDSON
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WILLIAM R. BLANCHARD

CLERICAL FORCE

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CHARLES F. SCHWEIKER, File Clerk and Stenographer
ALEJANDRO GARAY, Junior Stenographer
CONSTANTINO RODAS, Cashier
EUSEBIO DATOC, Property Clerk

THE BUREAU OF PRINTING MANILA, PHILIPPINE ISLANDS

THE ISLANDS

The Philippine Archipelago is composed of more than 3,000 islands, of which Mindanao and Luzon are the largest. Some 2,700 of them are small, each being less than 1 square mile in extent. The area of the islands of the group is estimated to be 115,000 square miles.

Main building of the Bureau of Printing

Y'Ami Island, about 1 mile in extent and the northernmost of the group, lies between 500 and 600 miles east of the southern coast of China, a little below the latitude of the city of Hongkong. More than 1,100 miles nearly due south of Y'Ami is Sitanki Island, the southernmost of the group, which lies a little more than 4½ degrees north of the equator and about 30 miles east of the great Island of Borneo.

The population is about 8,000,000. Officially the peoples are known as Christians and non-Christians. The Christians are credited as representing 90 per cent of the inhabitants; they comprise seven of the principal dialectic groups, which, arranged in the order of their rank in population, are as follows: Visayans, Tagalogs, Ilocanos, Bicols, Pangasinans, Pampangans, Cagayans. The non-Christian Igorots and the Mohammedan Moros are not without interest.

The "Bureau of Public Printing" was created by the Philippine Commission by a law approved November 7, 1901.

The pioneers chosen to install and prepare for operation a complete printing plant in a far-off land—alien in language, customs, and climate—performed a task of unusual proportions after encountering and overcoming many baffling details. To-day the Bureau of Printing compares favorably with any of the world's model printing plants, some of the Bureau's administrative features being used as models for other offices of the Philippine Government. Incidentally, it may be stated that the present Director is the sole representative in the Bureau of the first-comers.

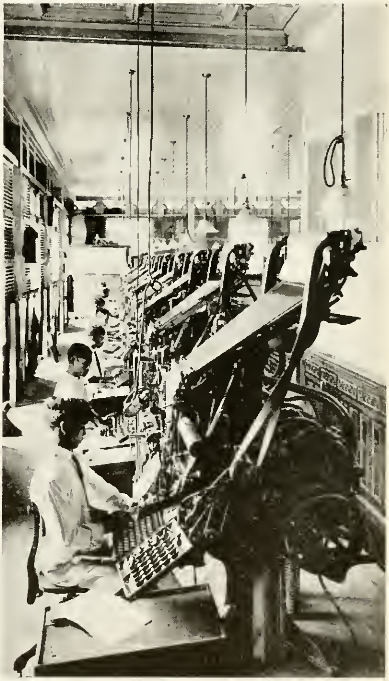
The printing plant is delightfully located in Ermita, a district of the city of Manila, in an open space bounded on all sides by streets. The main building is of two stories, quadrangular in shape, and has a large open court spanned by a bridge. Its front faces Calle P. Burgos (the new name for Bagumbayan, well known to all who have visited Manila). It is flanked by the City Hall on the south and the Meehan Gardens (old name, Botanical Garden) on the north. Across the street at the rear is the Division Hospital of the United States Army. Between the front of the building and the street is a beautiful lawn divided by an ample driveway which leads from Calle P. Burgos to the main entrance. The second-story front affords a fine view of part of the

A general view of the Composing Division old moat—now filled in and parts of it devoted to playgrounds, tennis courts, baseball and football grounds, etc.—and an easterly portion of the ancient Spanish wall, built of stone, which surrounds old Manila, known as Intramuros by the Spaniards and natives, and called "the Walled City" by Americans. The first floor of the main building contains the power plant and machine shop, pressroom, electrotype and stereotype foundry, paper and general supplies storerooms, and public document sales office. On the second floor are the offices occupied by the Director, the Assistant Director, and other administrative offices, and the workrooms of the composing, bindery, and photo-engraving divisions.

With due consideration of the requirements of the printing plant, it is found that the machinery, instruments, tools, and materials are efficient and well adapted, all being of the latest and most improved design.

Electric current generated by the power plant drives 147 motors ranging from ¼ to 7½ horsepower, furnishes 500 metallic-filament incandescent lights of 32 to 50 candle-power, supplies 10 electric heaters, and drives 47 ceiling and buzz fans.

The greater proportion of the type composition is accomplished by 20 linotype machines. The product of these machines shows a good average, keeping in mind that much of the copy is of a technical nature containing many unusual words, signs and symbols, black-faced type, italics, abbreviations, Latin, Greek, etc.; also nearly half of the composition is in Spanish, and occasionally jobs are set in one or more of the several native dialects.



Part of the battery of twenty linotypes, Composing Division

The pressroom ably handles the portion of work assigned to it. High praise has been given for some of the three- and four-color half-tone work it has turned out. Its presses are capable of producing 50,000,000 impressions per year.

The bindery is well able to take care of all the work coming to it, from the wire-stitched folder to the large full-bound blank book. For exhibition purposes it has produced some handsome volumes with hand-tooling and gilded edges in ornamental design.

The photo-engraving room does zinc and copper half-tone and zinc line-etching work. It has also produced some very fine three- and four-color half-tone plates. Brass and steel dies for embossed work are cut when ordered.

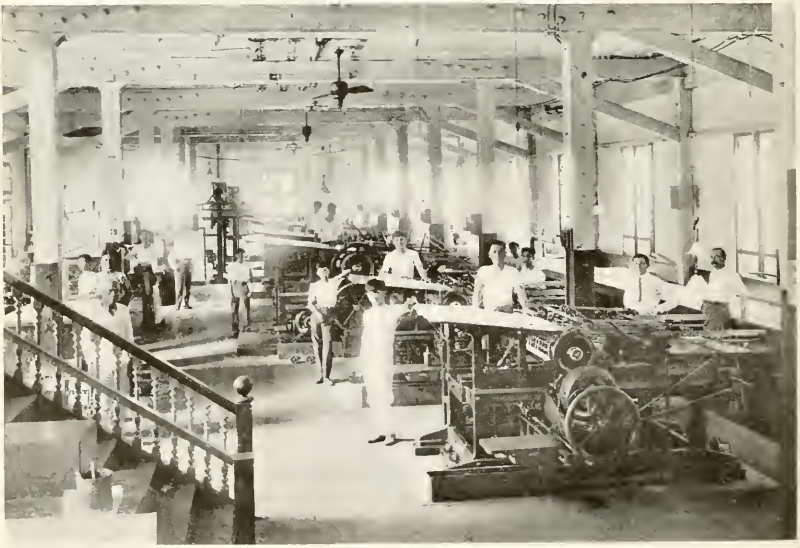
The electrotype and stereotype foundry, in addition to its regular work, also cuts steel dies for embossed work.

About 400 machines of various kinds are in use. Their efficient maintenance and repair is provided for by a well-equipped machine shop.

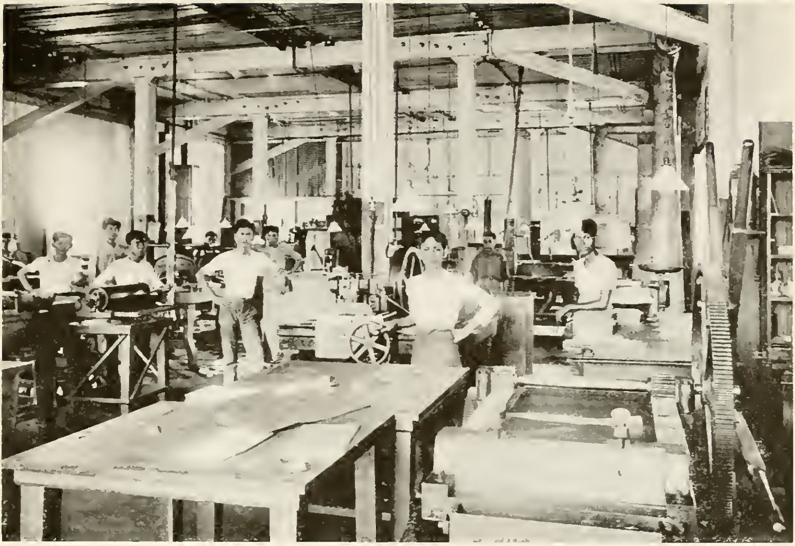
An interdivision telephone system contributes quick and easy communication between the various offices and divisions.

The items of production are of great variety. Possibly the largest item consists of blank forms and blank books. The next largest item is books of many kinds—laws and proceedings of the Legislature, decisions of the Supreme Court, reports of departments and bureaus, various manuals and regulations, and a number of periodical publications. In addition to the foregoing there is a large amount of miscellaneous work. The Bureau of Printing productions have gained the approval of some of the world's best-known master printers.

Nearly every item of material, machinery, paper, and supplies of all descriptions used by or entering into the finished product of the Bureau of Printing is imported from the United States. A "rush" order for materials, etc., from the United States requires about six months' time for delivery in Manila, and the regular orders come along in from nine to twelve months.



Cylinder-press section, Press Division



A general view of the Foundry Division

Sales of public documents average about ₱40,000 per annum.

The following gives an idea of the regularly issued publications:

OFFICIAL GAZETTE.

In the Official Gazette are printed: Laws and resolutions enacted by the Philippine Legislature and Philippine Commission; executive orders and proclamations issued by the Governor-General; decisions of the Philippine Supreme Court; orders of the Bureau of Customs; advertisements of various courts and offices of the Insular Government, composed mostly of land registration notices; and miscellaneous notices and orders of departments, bureaus, and offices of the Insular Government. Issued weekly. Annual volume makes about 2,300 pages. Size of type page, 7 by 10 inches.

GACETA OFICIAL.

Spanish edition of the Official Gazette. Averages about 2,400 pages per annum. Same contents and page size as the Official Gazette.

THE PHILIPPINE JOURNAL OF SCIENCE.

Published by the Bureau of Science in four sections, devoted to the following subjects:

Section A, chemical and geological sciences and the industries.
Section B, tropical medicine.
Section C, botany.
Section D, general biology, ethnology, and anthropology.

Each section is issued in 6 numbers per year, some of them profusely illustrated. The annual bound volume of each section averages over 400 pages, not including illustrations. Type page size, $4\frac{1}{3}$ by $7\frac{2}{3}$ inches.

PHILIPPINE AGRICULTURAL REVIEW.

Published by the Philippine Bureau of Agriculture. Devoted to agriculture, stock breeding, etc. Formerly issued monthly, now issued quarterly. Well illustrated. Annual bound volumes of past years averaged about 700 pages exclusive of illustrations. Size of type page, 4⅓ by 7⅔ inches.

REVISTA AGRÍCOLA DE FILIPINAS.

Spanish edition of the Agricultural Review. Same in all respects as the English edition. This publication has been discontinued, and in its stead The Philippine Farmer, an 8-page pamphlet, is to be published.

PHILIPPINE CRAFTSMAN.

Published by the Philippine Bureau of Education monthly during nine months of the school year (July to March). Devoted mainly to technical subjects pertaining to schools. The annual volume averages more than 700 pages; profusely illustrated. Size of type page, 4⅓ by 7⅔ inches.

MONTHLY WEATHER BULLETIN.

Published by the Philippine Weather Bureau. In this publication is found information of great value pertaining to the meteorology and the seismology of the Philippine Islands. The annual volume comprises about 400 pages. Size of type page, 6 by 9 inches.

BULLETIN OF THE PHILIPPINE LIBRARY.

Published by the Philippine Library monthly. Its main function is to show acquisitions to the library and reading lists of books on special subjects of current interest. Averages about 20 pages per number. Size of type page, 5 by 8 inches.

Finishers' section, Foundry Division

Forwarders' section, Bindery Division

BUREAU OF PUBLIC WORKS QUARTERLY BULLETIN.

Issued quarterly by the Philippine Bureau of Public Works. It is well illustrated and deals mainly with engineering problems concerning materials and the construction of buildings, bridges, and roads. It averages about 60 pages per number. Size of type page, 8 by 10½ inches.

QUARTERLY HEALTH REPORT.

Issued quarterly by the Philippine Bureau of Health. Contains statistical matter pertaining to the public health of the Philippine Islands. Averages about 50 pages per number. Size of type page, 7 by 10 inches.

The following is a statement of the principal kinds of papers consumed, including envelopes, for the fiscal years 1910 to 1914, inclusive:

Year.	Kind of paper.				Envelopes.
	Book.	Writing.	Bond and ledger.	Cardboard and bristol board.	
	Reams.	*Reams.*	*Reams.*	*Sheets.*	*Number.*
1910	4,020	5,116	1,788	171,550	3,691,171
1911	4,446	6,233	1,837	167,391	4,101,375
1912	5,860	6,496	1,927	239,737	4,773,325
1913	5,748	8,501	2,263	240,592	5,101,461
1914	5,321	8,048	1,937	204,462	5,724,361

SYSTEM OF APPRENTICE INSTRUCTION

The Bureau of Printing has instituted a system of apprentice instruction which is a radical departure from all known methods of vocational training. The practicability of its scheme has received world-wide approval. Leaders in the graphic arts and instructors in institutions devoted solely to teaching printing and its allied trades have expressed admiration at the fullness of its details and the coherence of its parts. Instructors in Harvard University, impressed with the thoroughness of the Bureau's system, have signified their intention of using its material in connection with the course in printing in the Harvard Graduate School of Business Administration.

The efficacy of the system is best evidenced by the evolution from an all-American force in 1902 to the present one composed of 94+ per cent of Filipino workmen. Of this native element, apprentices constitute 34.92 per cent. All of the mechanical work of the Bureau of Printing is being performed by Filipinos, Americans acting only in a supervisory capacity.

The following table, showing the American and Filipino employees in the Bureau of Printing for the periods stated, indicates the yearly progress the Filipinos have made:

Year ended—	Employees.		Year ended—	Employees.	
	American.	Filipino.		American.	Filipino.
Sept. 1, 1903	[a] 67	175	June 30, 1910	27	317
Sept. 1, 1904	[a] 52	222	June 30, 1911	27	377
Sept. 1, 1905	[a] 42	250	June 30, 1912	28	434
June 30, 1906	37	252	June 30, 1913	30	464
June 30, 1907	31	265	Dec. 31, 1913	27	441
June 30, 1908	27	313	Sept. 30, 1914	[b] 24	398
June 30, 1909	27	287			

[a] Information from annual reports.

[b] Thirteen of these are rated as craftsmen-instructors, the balance comprising administrative and other employees.

Apprentice instruction places the Bureau of Printing in a position unique among the world's printing offices. No other public or private *producing* establishment in existence is operated with so large a percentage of students comprising its technical force. In American and European printing offices the apportionment of apprentices to journeymen is on a basis of from 1-to-15 to 1-to-5, whereas in the Bureau of Printing the present ratio is about 1.1 apprentices to 1 native craftsman.

The Bureau, however, is not primarily a school of printing. It furnishes all the printing and binding for the Philippine Government and certain work for local stations of the United States Army and Navy. Among its customers are the various Insular bureaus and

Finishers and sewing machines, Bindery Division

offices, the Philippine Legislature, 38 provinces, and 725 municipalities. The plant is valued at ₱1,000,000.

The system of vocational training is commercially practicable in that it may be introduced into any manufacturing plant without any perceptible change in its routine, and apprentices may be paid wages from the date of the beginning of their apprenticeship.

Its principle, briefly, is this: The operations of each trade are segregated into specialties and subspecialties. These are divided into classes in the order of their relative importance, forming a systematic and coordinate sequence of instruction. A progressive schedule is thus provided—a step-by-step advancement which is as necessary to the proper industrial education of a boy as are the finger exercises in the acquirement of the finished technique of the expert musician.

The manner in which the specialties and subspecialties are arranged for each of the eight trades taught in the Bureau of Printing is shown in Plates I and II, pages 16, 17. Numbers are assigned to specialties and letters to subspecialties. Plates I and II pertain to the photo-engraving trade, which is divided into 41 specialties and 154 subspecialties.[1] The same general scheme is applied to each of the trades, the number of specialties and subspecialties in each division being as follows:

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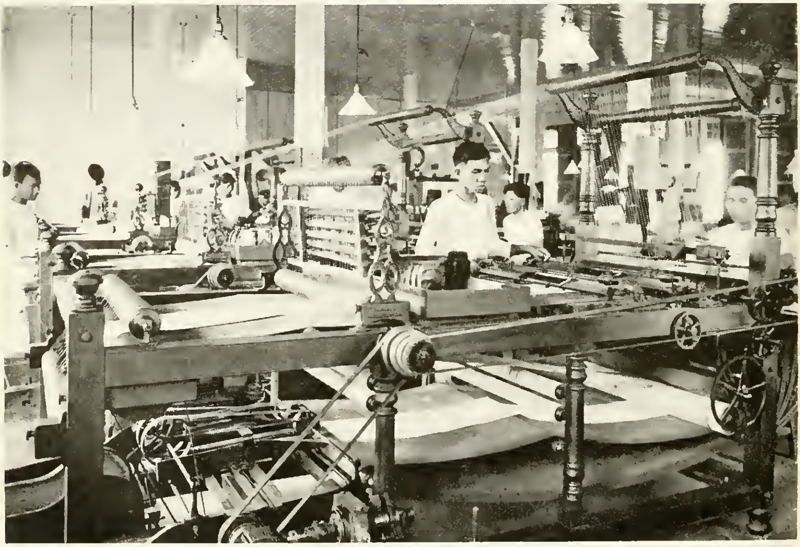
[1] In explanation of the hiatus from 32 to 101, it may be stated that the numbers assigned to specialties are the same for both the apprenticeship and cost-accounting systems of the Bureau, viz, 1 to 100, inclusive, for chargeable specialties; 101 and upward for nonchargeable specialties. A further division of chargeable specialties is made in those divisions having both machine and hand specialties, as follows: Machine, 1 to 50, inclusive; hand, 51 to 100, inclusive. This system of numbering enables the abstractor to make all entries from the workman's daily time ticket (pages 18 and 19) without reference to an explanatory list of specialties; and its advantages will be apparent when it is understood that machine and hand rates are segregated and that nonchargeable specialties ordinarily are not abstracted.

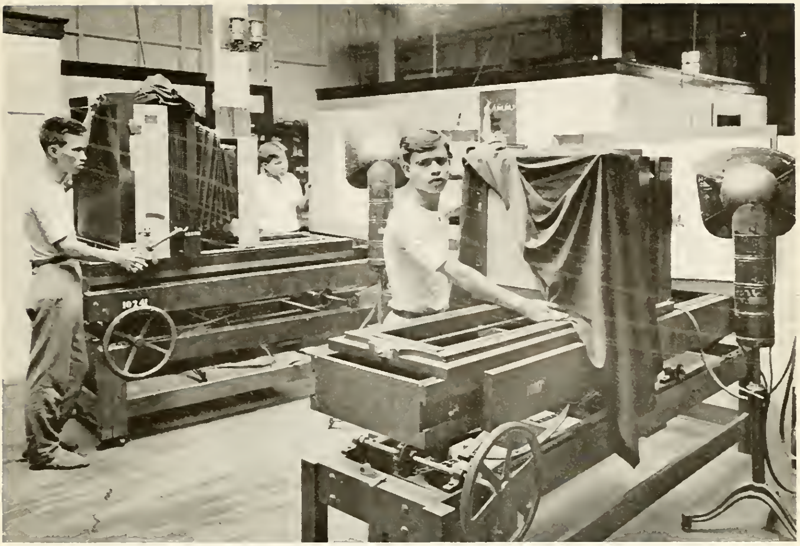
Trade.	Specialties.	Subspecialties.	Total.
Printer	47	258	305
Pressman	45	136	181
Bookbinder	74	196	270
Photo-engraver	41	154	195
Stereotyper and electrotyper	40	140	180
Total	247	884	1, 131

Fifty-five specialties and 265 subspecialties are taught in the auxiliary trades of engineer, machinist, and electrician, making a grand total of 302 specialties and 1,149 subspecialties in the eight trades mentioned.

The specialties of each trade are distributed over seven periods, or four years in all. During the first three years (six periods of six months each) the student is designated as an "apprentice," and in the final period of one year he is known as a "junior craftsman." It is not contended that within that time a superior workman can be evolved from the crude material, but the four-year period of systematic instruction has proven adequate for turning out workmen who have assimilated a general knowledge of all the specialties of their trades. A comprehensive technical reference library, available to all, affords an excellent medium for self-education in office administration and organization, the



Ruling machines, Bindery Division



Cameras in the Photo-Engraving Division

relations of the various printing trades to each other, and the physical qualities of the more important printing-office materials.

Bureau of Printing apprentices have a distinct advantage in not being required to devote any part of their time to running errands, "sweeping out," and other tasks that usually occupy the greater part of the first year of apprentices elsewhere.

The first class period of six months is considered ample in which to determine an apprentice's fitness for the trade to which he has been assigned. If he shows inaptitude, particularly with respect to mechanical details, he is advised to seek other fields of labor. Justice to the employee as well as to the employer demands frankness in a matter that influences the formative period of a boy's life. If an apprentice demonstrates aptitude during his first class period but is unable to qualify for promotion within the prescribed period of six months, he is retained in the class until he has thoroughly mastered the specialties of that class period. The extension, however, in no case exceeds three months. If, after three months' extension, an apprentice fails to qualify for promotion, he is separated from the service.

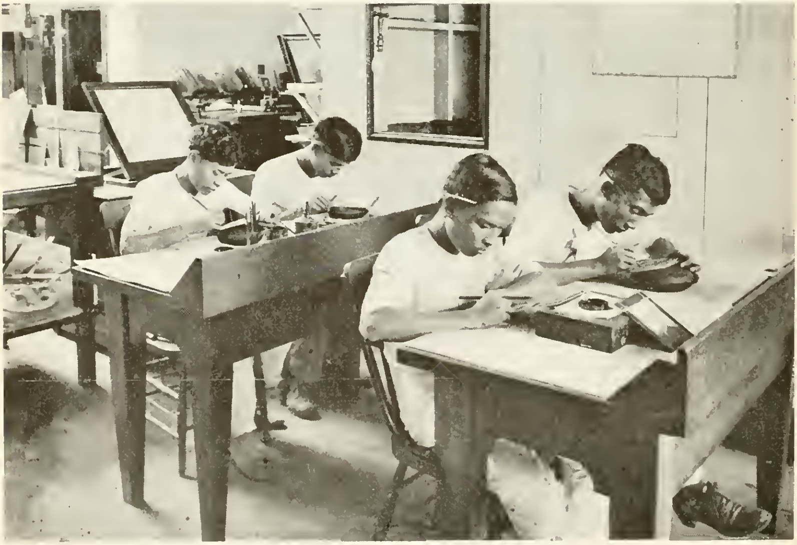
A prerequisite to the success of any apprenticeship system is the employment of instructors who are thoroughly skilled in their work. The attitude of a craftsman-instructor toward an apprentice is similar to that of a teacher and pupil in a school. Instructors take a personal interest in the work of each apprentice, carefully explaining every operation. The apprentice is never forced to acquire his knowledge through chance contact with other workmen. He is given a scheduled task and shown the proper manner in which it should be performed.

Upon entrance each apprentice is given a pamphlet containing the office rules. Infractions of the rules and cases of carelessness and insubordination are made a matter of record. Verbal reprimands by craftsmen-instructors are not permitted. Adverse reports in the form of letters of reprimand are sent to the offending employees, who are given opportunity to make statements in their own behalf. Adverse reports are also made in cases of errors which are manifestly due to carelessness or inattention. These reports are filed, and when the employee's efficiency record is compiled a deduction is made for each. Letters of commendation are given to apprentices for exceptionally meritorious work.

Instruction in the operation and the ordinary adjustment of machinery is imparted by the immediate instructor, while the technical knowledge of a machine and its parts is acquired from the chief machinist. All power-driven machinery of the Bureau of Printing is inspected three times a year, according to a dated schedule.

The Bureau of Printing Desk Book is the only technical publication used in connection with apprentice instruction. It has been indorsed by American and foreign publishers and is recognized as a standard work of reference in the printing trades.

A comprehensive list of technical terms and definitions peculiar to each trade, printed in pamphlet form, is given to each apprentice, junior craftsman, and craftsman.



Apprentice etchers of the Photo-Engraving Division

Each apprentice is orally examined by his foreman as to his knowledge of such terms and definitions, and none is promoted who does not possess information to the extent of securing a passable rating.

After an employee has assumed the duties of a craftsman, additional responsibilities are placed upon him and every effort is made to inspire him with the confidence necessary to enable him to act in a minor executive capacity, such as assistant to the foreman or in charge of a group of workmen.

Apprentices are selected for appointment from lists of eligibles certified by the Bureau of Civil Service of the Philippine Government. Minimum and maximum age limits are 15 and 20 years, respectively. Each appointee must be in good physical condition and must weigh not less than 46 kilos (112 pounds) and be at least 155 centimeters (5 feet 1 inch) in height. His general fitness for an indoor occupation must be unquestioned.

Apprentices are rated on quantity of work; quality of work; aptitude and adaptability; habits, character, and conduct; and attendance and physical condition. Promotions from one class to another are made when the apprentice has qualified in all the specialties included in his current class. The Bureau's daily time ticket, a facsimile reproduction of which is shown in pages 18 and 19, is useful in determining the rating for quantity. The apprentice must have completed the full period of six months, as the class period is extended in an amount of time equal to that which may have been lost for any cause whatsoever.

Prior to promotion at the end of every class period and before graduation to craftsmanship, each apprentice is required to go to the examination room and, aided only by memory, write in English a theme on one or more subjects pertaining to his past or current work.

The Bureau of Printing has been a vocational school of the best kind for the Filipinos who have entered its service. They have learned the value of continued and earnest application to one of the most useful of arts, and to seek for superiority and excellence in their work. While the Bureau has been indispensable in the effective performance of the work of the Government, yet it has had even greater value as a training school for the Filipinos. It has been effective in improving the art of printing throughout the Islands and has also been a most useful instrumentality in extending the use of the English language through its dissemination by the intelligent and progressive young Filipinos who go from its service to engage in enterprises of their own or as the employees of others.

The success which has attended the technical training of apprentices in the Bureau of Printing has demonstrated beyond peradventure that the application of *system* to vocational training will produce efficient workmen in *any* of the skilled trades.

PLATE I

Manner in which All Operations of Each Trade Are Segregated Into Specialties and Subspecialties. The Eight Trades Taught in the Bureau of Printing Consist of 302 Specialties and 1,149 Subspecialties. Instruction in Each Trade Is Imparted According to an Invariable Schedule (see Plate II)

PHOTO-ENGRAVING SPECIALTIES

CHARGEABLE

1. Alterations.
2. Anchoring:
    - (a) Drilling anchor holes.
    - (b) Countersinking anchor holes.
    - (c) Outlining anchor marks.
    - (d) Tinning anchor marks.
    - (e) Casting anchors.
3. Beveling, plain:
    - (a) Adjusting mechanism.
    - (b) Aligning plate with line gauge and clamping down.
    - (c) Beveling, leaving plain border.
    - (d) Cutting graved or white line
    - (e) Beveling, leaving black and white line border.
4. Beveling, special (lining):
    - (a) Adjusting mechanism.
    - (b) Aligning plate with line gauge
    - (c) Cutting black and white lines in multiple or extended lines.
    - (d) Making raised border line by burring up
    - (e) Cutting raised line down to printing surface and graving white line.
    - (f) Beveling.
5. Blocking or mounting:
    - (a) Adjusting mechanism.
    - (b) Center punching for countersinks.
    - (c) Drilling countersinks for tack heads.
    - (d) Planing blocking wood smooth on one side.
    - (e) Nailing cuts to blocks.
    - (f) Planing mounts type high.
    - (g) Trimming and squaring blocks.
    - (h) Sandpapering corners and raw edges.
    - (i) Routing out large blanks.
    - (j) Blocking or mounting to register.
6. Cut outs:
    - (a) Tooling outline.
    - (b) Routing.
    - (c) Trimming.
7. Cutting circles or ovals:
    - (a) Cutting cardboard mat to size.
    - (b) Trimming negative by mat.
    - (c) Tooling outline.
    - (d) Routing.
    - (e) Trimming.
8. Drawing (illustrating, designing, lettering
    - (a) Pen.
    - (b) Wash.
    - (c) Air brush.
    - (d) Colors.
    - (e) Preparing black and white copy for color reproductions.
    - (f) Coloring transparencies.
9. Etching, copper, half-tone:
    - (a) Flat etch.
    - (b) Staging and reëtching.
    - (c) Trial proof.
    - (d) Preparing and mixing etching solutions.
10. Etching, copper, line:
    - (a) Etching line print.
    - (b) Retouching etching.
    - (c) Powdering and burning in line work.
    - (d) Preparing and mixing etching solutions.
11. Etching, half-tone, color:
    - (a) Flat etch.
    - (b) Trial proof.
    - (c) Staging and reëtching.
    - (d) Preparing and mixing etching solutions.
12. Etching, zinc, half-tone:
    - (a) Flat etch.
    - (b) Staging and reëtching.
    - (c) Trial proof.
    - (d) Preparing and mixing etching solutions.
13. Etching, zinc, line.
    - (a) Etching line print
    - (b) Retouching etching.
    - (c) Powdering and burning in line work.
    - (d) Preparing and mixing etching solutions
14. Finishing, half-tone:
    - (a) Spotting.
    - (b) Extending corner lines.
    - (c) Burnishing.
15. Finishing, half-tone, color:
    - (a) Spotting.
    - (b) Extending corner lines.
    - (c) Burnishing.
    - (d) Outlining for cut outs.
    - (e) Trimming cut outs.
    - (f) High-lighting.
16. Finishing, line:
    - (a) Spotting.
    - (b) Trimming.
    - (c) Repairing.
    - (d) Correcting.
17. Mortising:
    - (a) Adjusting mechanism.
    - (b) Outside mortising.
    - (c) Inside mortising.
18. Mounting or grouping original copy:
    - (a) Grouping of copy for half-tone reproduction.
    - (b) Grouping negatives for printing.
    - (c) Grouping or arranging objects for half-tone reproduction, color work, and dry-plate photography.
19. Photographing, color operating; making color record negatives:
    - (a) Color sensitizing dry plates.
    - (b) Focusing color copy.
    - (c) Exposing color sensitized plates through color filters.
    - (d) Developing record negatives.
    - (e) Clearing and fixing record negatives.
    - (f) Intensifying record negatives.
    - (g) Reducing record negatives.
    - (h) Printing transparencies from record negatives.
    - (i) Developing transparencies.
    - (j) Clearing and fixing transparencies.
    - (k) Intensifying transparencies.
    - (l) Reducing transparencies
    - (m) Preparing dye solutions for color sensitizing.
    - (n) Preparing and mixing chemicals.
20. Photographing, dry-plate work.
    - (a) Interior views.
    - (b) Outside views.
    - (c) Copying prints, enlargement or reduction.
    - (d) Preparing copy from colored pictures or objects for half-tone reproduction.
    - (e) Making transparencies.
    - (f) Mounting prints.
    - (g) Preparing and mixing chemicals.
21. Photographing, half-tone:
    - (a) Focusing copy.
    - (b) Collodionizing and sensitizing plates.
    - (c) Adjusting screen.
    - (d) Placing plate in plate holder and timing exposure.
    - (e) Developing negative.
    - (f) Clearing negative
    - (g) Intensifying negatives.
    - (h) Clearing and cutting negative with cyanide.
    - (i) Final intensification.
    - (j) Preparing and mixing chemicals.
22. Photographing, half tone, special (reproduction of pencil drawings, etchings, and steel or copperplate prints).
23. Photographing, line:
    - (a) Focusing line.
    - (b) Collodionizing and sensitizing plate.
    - (c) Placing plate in plate holder and timing exposure.
    - (d) Developing negative.
    - (e) Clearing out developer with cyanide.
    - (f) Intensifying negative.
    - (g) Clearing negative.
    - (h) Final intensification.
    - (i) Final clearing.
24. Printing negatives:
    - (a) Sawing and polishing metal.
    - (b) Coating metal with sensitizing solution.
    - (c) Printing negatives.
    - (d) Rolling up print.
    - (e) Washing and developing out plate after printing.
    - (f) Burning or baking in enamel.
    - (g) Retouching print.
    - (h) Preparing and mixing line and half-tone printing solutions.
25. Proofing:
    - (a) Black and white.
    - (b) Color.
26. Reëngraving.
27. Retouching:
    - (a) Copy.
    - (b) Negatives.
    - (c) Plates.
28. Routing:
    - (a) Adjusting mechanism.
    - (b) Line work.
    - (c) Half-tone cut out work.
    - (d) Sharpening router bits.
29. Stripping negatives:
    - (a) Coating negatives with rubber.
    - (b) Coating negatives with collodion.
    - (c) Cutting and squaring negative film.
    - (d) Stripping, reversing, and transferring negative film to plate glass.
    - (e) Preparing and mixing stripping solutions.
30. Transparencies.
31. Vignetting:
    - (a) Outlining.
    - (b) Tooling
    - (c) Etching
    - (d) Routing.
    - (e) Trimming.
    - (f) Underlaying.
32. Zinc overlays:
    - (a) Cutting zinc to size.
    - (b) Cleaning and polishing.
    - (c) Drying.
    - (d) Pulling offset on zinc.
    - (e) Retouching zinc offset.
    - (f) Powdering and burning in.
    - (g) Etching.

NONCHARGEABLE

101. Cleaning machinery.
102. Corrections, office.
103. Instructing apprentices.
104. Laborer.
105. Mixing and preparing chemicals.
106. Practice work.
107. Supervising, inspecting finished product, and similar work.
108. Waiting for repairs (write name of machine.)
109. Waiting for work (will not be allowed unless employee reports immediately to the Foreman).

PLATE II

Showing the Manner in Which Specialties and Subspecialties Are Divided Into Classes in the Order of Their Relative Importance, Making a Systematic and Coördinate Sequence of Instruction

APPRENTICE

THREE YEARS, DIVIDED INTO SIX CLASSES OF SIX MONTHS EACH

Class 6 (Entrance).	Class 5.	Class 4.
24. Printing negatives [line]: (a) Sawing and polishing metal. (b) Coating metal with sensitizing solution. (c) Printing negatives. (d) Rolling up print. (e) Washing and developing out plate after printing. (f) Burning or baking in enamel. (g) Retouching print. (h) Preparing and mixing line and half-tone printing solutions. 13. Etching, zinc line: (a) Etching line print. (b) Retouching etching. (c) Powdering and burning in line work. (d) Preparing and mixing etching solutions. 5. Blocking or mounting: (a) Adjusting mechanism. (b) Center punching for countersinks. (c) Drilling countersinks for tack heads. (d) Planing blocking wood smooth on one side. (e) Nailing cuts to blocks. (f) Planing mounts type high. (g) Trimming and squaring blocks. (h) Sandpapering corners and raw edges. (i) Routing out large blanks. (j) Blocking or mounting to register. 105. Mixing and preparing chemicals.	28. Routing: (a) Adjusting mechanism. (b) Line work. (c) Half-tone cut out work. (d) Sharpening router bits. 17. Mortising: (a) Adjusting mechanism. (b) Outside mortising. (c) Inside mortising. 29. Stripping negatives [line]: (a) Coating negatives with rubber. (b) Coating negatives with collodion. (c) Cutting and squaring negative film. (d) Stripping, reversing, and transferring negative film to plate glass. (e) Preparing and mixing stripping solutions. 105. Mixing and preparing chemicals.	24. Printing negatives [half-tone]: (a) Sawing and polishing metal. (b) Coating metal with sensitizing solution. (c) Printing negatives. (e) Washing and developing out plate after printing. (f) Burning or baking in enamel. (g) Retouching print. (h) Preparing and mixing line and half-tone printing solutions. 32. Zinc overlays: (a) Cutting zinc to size. (b) Cleaning and polishing. (c) Drying. (d) Pulling offset on zinc. (e) Retouching zinc offset. (f) Powdering and burning in. (g) Etching 10. Etching, copper, line: (a) Etching line print. (b) Retouching etching. (c) Powdering and burning in line work. (d) Preparing and mixing etching solutions. 105. Mixing and preparing chemicals.
Class 3.	**Class 2.**	**Class 1.**
29. Stripping negatives [half-tone]: (a) Coating negatives with rubber. (b) Coating negatives with collodion. (c) Cutting and squaring negative film. (d) Stripping, reversing, and transferring negative film to plate glass. (e) Preparing and mixing stripping solutions. 18. Mounting or grouping original copy: (b) Grouping negatives for printing. 12. Etching, zinc, half-tone: (a) Flat etch. (b) Staging and reëtching. (c) Trial proof. (d) Preparing and mixing etching solutions. 3. Beveling, plain: (a) Adjusting mechanism. (b) Aligning plate with line gauge and clamping down. (c) Beveling, leaving plain border. (d) Cutting graved or white line. (e) Beveling, leaving black and white line border. 4 Beveling, special (lining): (a) Adjusting mechanism. (b) Aligning plate with line gauge. (c) Cutting black and white lines in multiple or extended lines. (d) Making raised border line by burring up. (e) Cutting raised line down to printing surface and graving white line. (f) Beveling. 16. Finishing, line: (a) Spotting. (b) Trimming. (c) Repairing. (d) Correcting. 25. Proofing: (a) Black and white. 105. Mixing and preparing chemicals.	1. Alterations. 2. Anchoring: (a) Drilling anchor holes (b) Countersinking anchor holes. (c) Outlining anchor marks. (d) Tinning anchor marks. (e) Casting anchors. 9. Etching, copper, half-tone: (a) Flat etch. (b) Staging and reëtching. (c) Trial proof. (d) Preparing and mixing etching solutions. 27. Retouching: (c) Plates. 14. Finishing, half-tone: (a) Spotting. (b) Extending corner lines. (c) Burnishing. 6. Cut outs: (a) Tooling outline. (b) Routing. (c) Trimming. 7. Cutting circles or ovals: (a) Cutting cardboard mat to size. (b) Trimming negative by mat. (c) Tooling outline. (d) Routing. (e) Trimming. 31. Vignetting: (a) Outlining. (b) Tooling. (c) Etching. (d) Routing. (e) Trimming. (f) Underlaying. 105 Mixing and preparing chemicals.	23. Photographing, line: (a) Focusing line. (b) Collodionizing and sensitizing plates. (c) Placing plate in plate holder and timing exposure. (d) Developing negative. (e) Clearing out developer with cyanide. (f) Intensifying negative. (g) Clearing negative. (h) Final intensification. (i) Final clearing. 21 Photographing, half tone: (a) Focusing copy (b) Collodionizing and sensitizing plates. (c) Adjusting screen. (d) Placing plate in plate holder and timing exposure. (e) Developing negative. (f) Clearing negative. (g) Intensifying negatives. (h) Clearing and cutting negative with cyanide. (i) Final intensification. (j) Preparing and mixing chemicals. 18. Mounting or grouping original copy: (a) Grouping of copy for half-tone reproduction. 22. Photographing, half-tone, special (reproduction of pencil drawings, etchings, and steel or copperplate prints). 105. Mixing and preparing chemicals.

JUNIOR CRAFTSMAN

ONE YEAR

This period shall be devoted to a review of the work of apprenticeship. In addition, elementary work shall be done on the following specialties should there be sufficient work to afford the opportunity and the junior craftsman have demonstrated more than average proficiency in all of his previous work.

20. Photographing, dry-plate work: (a) Interior views. (b) Outside views. (c) Copying prints, enlargement or reduction. (d) Preparing copy from colored pictures or objects for half-tone reproduction. (e) Making transparencies. (f) Mounting prints. (g) Preparing and mixing chemicals. 18 Mounting or grouping original copy: (c) Grouping or arranging objects for half-tone reproduction, color work, and dry-plate photography. 30. Transparencies. 27. Retouching: (a) Copy (b) Negatives.	19. Photographing, color operating; making color record negatives: (a) Color sensitizing dry plates. (b) Focusing color copy. (c) Exposing color sensitized plates through color filters. (d) Developing record negatives. (e) Clearing and fixing record negatives. (f) Intensifying record negatives. (g) Reducing record negatives. (h) Printing transparencies from record negatives. (i) Developing transparencies. (j) Clearing and fixing transparencies. (k) Intensifying transparencies. (l) Reducing transparencies. (m) Preparing dye solutions for color sensitizing. (n) Preparing and mixing chemicals. 11. Etching, half-tone, color: (a) Flat etch. (b) Trial proof. (c) Staging and reëtching (d) Preparing and mixing etching solutions.	15. Finishing, half-tone, color: (a) Spotting. (b) Extending corner lines. (c) Burnishing. (d) Outlining for cut outs. (e) Trimming cut outs. (f) High-lighting. 25. Proofing. (b) Color. 26. Reëngraving. 8. Drawing (illustrating, designing, lettering): (a) Pen. (b) Wash. (c) Air brush. (d) Colors. (e) Preparing black and white copy for color reproductions. (f) Coloring transparencies. 105. Mixing and preparing chemicals.

WORKMAN'S DAILY TIME TICKET

PHOTO-ENGRAVING DIVISION

REGULAR TIME

Date.. .... I certify on my official oath that the time noted on this ticket is correct.

Rate of pay, ₱............ Name ....
Craftsman. Junior Craftsman. Apprentice. Helper.

A. M.

Work Order Number.	Time.	Part	Specialty Number; also Quantity when Ordered.	Office Use.			
	8.00			Hand.		Mach.	
	8.06	1					
	8.12	2					
	8.18	3					
	8.24	4					
	8.30	5					
	8.36	6					
	8.42	7					
	8.48	8					
	8.54	9					
	9.00	10					
	9.06	11					
	9.12	12					
	9.18	13					
	9.24	14					
	9.30	15					
	9.36	16					
	9.42	17					
	9.48	18					
	9.54	19					
	10.00	20					
	10.06	21					
	10.12	22					
	10.18	23					
	10.24	24					
	10.30	25					
	10.36	26					
	10.42	27					
	10.48	28					
	10.54	29					
	11.00	30					
	11.06	31					
	11.12	32					
	11.18	33					
	11.24	34					
	11.30	35					
	11.36	36					
	11.42	37					
	11.48	38					
	11.54	39					
	12.00	40					

P. M.

Work Order Number.	Time.	Part.	Specialty Number; also Quantity when Ordered.	Office Use			
	1.00			Hand.		Mach	
	1.06	41					
	1.12	42					
	1.18	43					
	1.24	44					
	1.30	45					
	1.36	46					
	1.42	47					
	1.48	48					
	1.54	49					
	2.00	50					
	2.06	51					
	2.12	52					
	2.18	53					
	2.24	54					
	2.30	55					
	2.36	56					
	2.42	57					
	2.48	58					
	2.54	59					
	3.00	60					
	3.06	61					
	3.12	62					
	3.18	63					
	3.24	64					
	3.30	65					
	3.36	66					
	3.42	67					
	3.48	68					
	3.54	69					
	4.00	70					

O. K. ....
For the Foreman.

ACCURATE TIME MUST BE KEPT.

(SEE OTHER SIDE FOR NUMBERED SPECIALTIES AND INSTRUCTIONS)

Upon beginning work, the employee enters the work-order number and the specialty number in the respective columns. If the time of beginning is 8 o'clock, the work-order and specialty numbers are entered opposite the first part or period—8.06 o'clock. Each period consists of six minutes, and the time printed is the last minute of the period. Should work on a different specialty on the same work order be started at 8.30 o'clock, then that specialty number is entered in the space directly opposite 8.36. One entry of a work-order number is sufficient, and this entry is made at the time of beginning a new work order. It is not necessary to mark off the time on this ticket, as the form has been ruled to obviate such work. All numbers must be carefully verified.

WORKMAN'S DAILY TIME TICKET

SPECIALTIES

Chargeable

1. Alterations.
2. Anchoring.
3. Beveling, plain.
4. Beveling, special (lining).
5. Blocking or mounting.
6. Cutouts.
7. Cutting circles or ovals.
8. Drawing (illustrating, designing, lettering).
9. Etching, copper, half-tone.
10. Etching, copper, line.
11. Etching, half-tone, color.
12. Etching, zinc, half-tone.
13. Etching, zinc, line.
14. Finishing, half-tone.
15. Finishing, half-tone, color.
16. Finishing, line.
17. Mortising.
18. Mounting or grouping original copy.
19. Photographing, color operating; making color record negatives.
20. Photographing, dry-plate work.
21. Photographing, half-tone.
22. Photographing, half-tone, special (reproduction of pencil drawings, etchings, and steel or copperplate prints).

Chargeable—Continued

23. Photographing, line.
24. Printing negatives.
25. Proofing.
26. Reëngraving.
27. Retouching.
28. Routing.
29. Stripping negatives.
30. Transparencies.
31. Vignetting.
32. Zinc overlays.

Nonchargeable

101. Cleaning machinery.
102. Corrections, office.
103. Instructing apprentices.
104. Laborer.
105. Mixing and preparing chemicals.
106. Practice work.
107. Supervising, inspecting finished product, and similar work.
108. Waiting for repairs (write name of machine).
109. Waiting for work (will not be allowed unless employee reports immediately to the foreman).

DESCRIPTION OF WORKMAN'S DAILY TIME TICKET

Arrangement.—The face of the ticket contains a complete record of the day's work, as well as all data pertaining to the compensation and status of the workman. This information is valuable to the instructor in determining the rating for "quantity" and to the inspector or computer in cases of excessive time. It enables the abstractor to complete and total all entries at a glance.

Sexagesimal notation.—Calculations are greatly simplified by dividing the time into six-minute periods, or the hour into tenths. The abstractor is further aided by reason of the heavy line under each fifth period, which divides the workday into half-hour periods.

Advantages of the printed horizontal lines.—The original Bureau of Printing time tickets were printed without horizontal lines under the different periods. These were drawn by the workman upon the completion of each work order or specialty. This work was not only objectionable to the workman, but the completed ticket, particularly for small work, was in many cases so badly accomplished and soiled as to greatly increase the work of abstracting. The elimination of this work through the printing of the horizontal lines has reduced the number of entries to the minimum.

The "Part" column.—The "Part" column enables the abstractor to determine at a glance how many tenths of an hour are consumed. The value of this time for any wage is quickly obtained by referring to a prepared table of computations, with the different rates of pay as headings of columns and the parts from 1 up as a guide column.

How to obtain quantity.—It is necessary at times to know the quantity of production. Provision is made for such information in the "Specialty" column.

Specialties, and how numbered.—Plate I shows the manner in which specialties are numbered. As all data required for abstracting purposes are shown on the face of the ticket, this system enables one Filipino clerk to abstract the daily time tickets of several hundred workmen.

(Owing to limited space, only a reduction of the front of the time ticket is shown on the opposite page. The actual size of the ticket is 7 by 8½ inches. The reverse sides of originals contain detailed instructions relative to making out the ticket, as well as a complete list of specialties of each mechanical division. Plates I, II, and III refer to photo-engraving operations.)

How chargeable time is gathered.—Chargeable hours only are gathered unless information is desired on a nonchargeable specialty. The total of nonchargeable hours is obtained by subtracting the gathered chargeable hours from the pay-roll hours.

Miscellaneous advantages of a time ticket.—It constitutes the most accurate record of a workman's efficiency.

It is the only means of accurately determining the cost of the individual job.

It is indispensable in formulating a scale of charges, for without reliable data as to costs the fixing of charges would be mere guesswork.

It provides accurate information relative to the status of a work order.

BUREAU
OF
PRINTING
MANILA

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